The

Journal of Heredity

(Formerly the American Breeders' Magazine)

Vol. VI, No. 4 April, 1915

CONTENTS

The White Leghorn, by Philip B. Hadley 147
Plant Breeding Correlations 151
Johannsen to Visit America 151
Influence of Stock on Cion, by B. S. Brown 152
Redfield Offer Remains Open 157
Education and Race Suicide, by Robert J. Sprague 158
Lectures in Eugenics 162
A Dent in the Forehead, by Charles B. Davenport 163
Heredity of White Fore-lock, by Newton Miller 165
Breeding Hardy Winter Barley 168
Eugenics and Immigration, by Dr. L. E. Cofer 170
Breeding Sugar Beets 174
Fancy Points vs. Utility, by A. F. Blakeslee 175
New Publications: Plant Breeding, by L. H. Bailey and Arthur W. Gilbert 181
To Grow Pedigreed Seeds 181
Hardier Spineless Cactus, by David Griffiths 182
Bud Selection Fails 191
Raspberry Breeding 191
The Pomerange, by Lindsay S. Perkins 192

The Journal of Heredity is published monthly by the American Genetic Association (formerly called the American Breeders' Association) for the benefit of its members. Canadian members who desire to receive it should send 25 cents a year, in addition to their regular membership dues of $2, because of additional postage on the magazine; foreign members pay 50 cents extra for the same reason. Subscription price to non-members, $2.00 a year, foreign postage extra; price of single copies, 25 cents.

Entered as second-class matter February 24, 1915, at the postoffice at Washington, D. C., under the act of August 24, 1912. Contents copyrighted 1915 by the American Genetic Association. Reproduction of articles or parts of articles permitted provided proper credit is given to author and to the Journal of Heredity (Organ of the American Genetic Association), Washington, D. C.

Date of issue of this number, March 25, 1915.

A CONGENITAL BLAZE IN THE HAIR

The white lock of hair here shown is hereditary and has been traced definitely through six generations; family tradition traces it on back to a son of Harry "Hot-Spur" Percy, born in 1403, and superstitiously assigns its origin to "pre-natal influence" or "maternal impression." This young woman, who is designated as V. 13 in the pedigree chart of the family (Fig. 10), inherited the blaze from her father, who had it from his mother, who had it from her father, a Dr. Little who emigrated to America from England nearly a century ago. The trait appears to be a simple dominant, following Mendel's Law, in its distribution; that is, when a person with one of these locks marries a normal person, half of the children show the lock and half do not. (Frontispiece.)

See "Heredity of White Fore-lock," p. 165.

THE WHITE LEGHORN

A Masquerader Who Conceals Many Colors and Patterns Under Her Pure White Plumage—Results of Genetic Breeding—Need for New "Standard of Perfection" Telling Not How Fowls Ought to Look, but How They Ought to Breed.

PHILIP B. HADLEY

Division of Animal Breeding and Pathology, Agricultural Experiment Station of the Rhode Island State College, Kingston, R. I.

NOTWITHSTANDING the many years that several varieties of poultry have been bred, the fact remains that we are still ignorant of the actual constitution of practically all of them, so far as the character-complex is concerned. Although many breeds have been evolved, and poultrymen refer to these breeds by names which have become standardized through many countries, it must be granted that these breed-names are practically meaningless to the genetist; and in so far as they carry any implication other than that of the *appearance* of the breed, they are also quite as meaningless to the poultryman. An example of what is meant is to be found in the case of that variety of fowl ordinarily called the White Leghorn, of somewhat uncertain origin.

The White Leghorn, which at present happens to be one of the most popular breeds, is ordinarily a pure white bird without pattern or markings, the beak and shanks being yellow. No other pigment is manifested. The eye is ordinarily bay. The white plumage color, unlike that of most white breeds, is a dominant white; that is, in crosses with black breeds the black is recessive. So long as the White Leghorns are bred among themselves, no other characters appear. Properly devised cross-breeding, however, tells a different story, and it is the aim of this paper to review briefly the results of experimental studies which demonstrate what sort of a bird the White Leghorn really is with respect to some of her breeding capabilites.

If a White Leghorn male is mated with a self-colored black like the Black Hamburg, Black Minorca, Black Spanish, or Black Langshan, the first generation progeny are commonly white. Close inspection, however, will reveal in the feathers of most of the birds minute flecks of black. Sometimes these are large enough to amount to actual splashes and occasionally one may find in the wing coverts or tail a feather which has several bars near the tip. All the birds are, however, mainly white. The Leghorn white is dominant over black.

THE SECOND GENERATION.

If, now, these F_1 birds are mated together, F_2 gives something of a variety of colors and markings. Among every sixteen adult birds, twelve are white and four are dark colored. The dark colored birds are found to include three that are barred and one that is black. Of the barred birds, two are males and one is a female. The one black individual in the sixteen is always a female. The barred birds are usually fully barred, but the character of the barring is inferior to that of the standard Barred Plymouth Rocks. The bars are less regular and the background is likely to be gray or smoky. There is, however, no question regarding the fact of the barring. One of these barred birds together with its parents and grandparents (White Leghorn and Black Hamburg) are shown in some of the figures accompanying this article.

The question at once arises—What is the origin of this barred pattern which

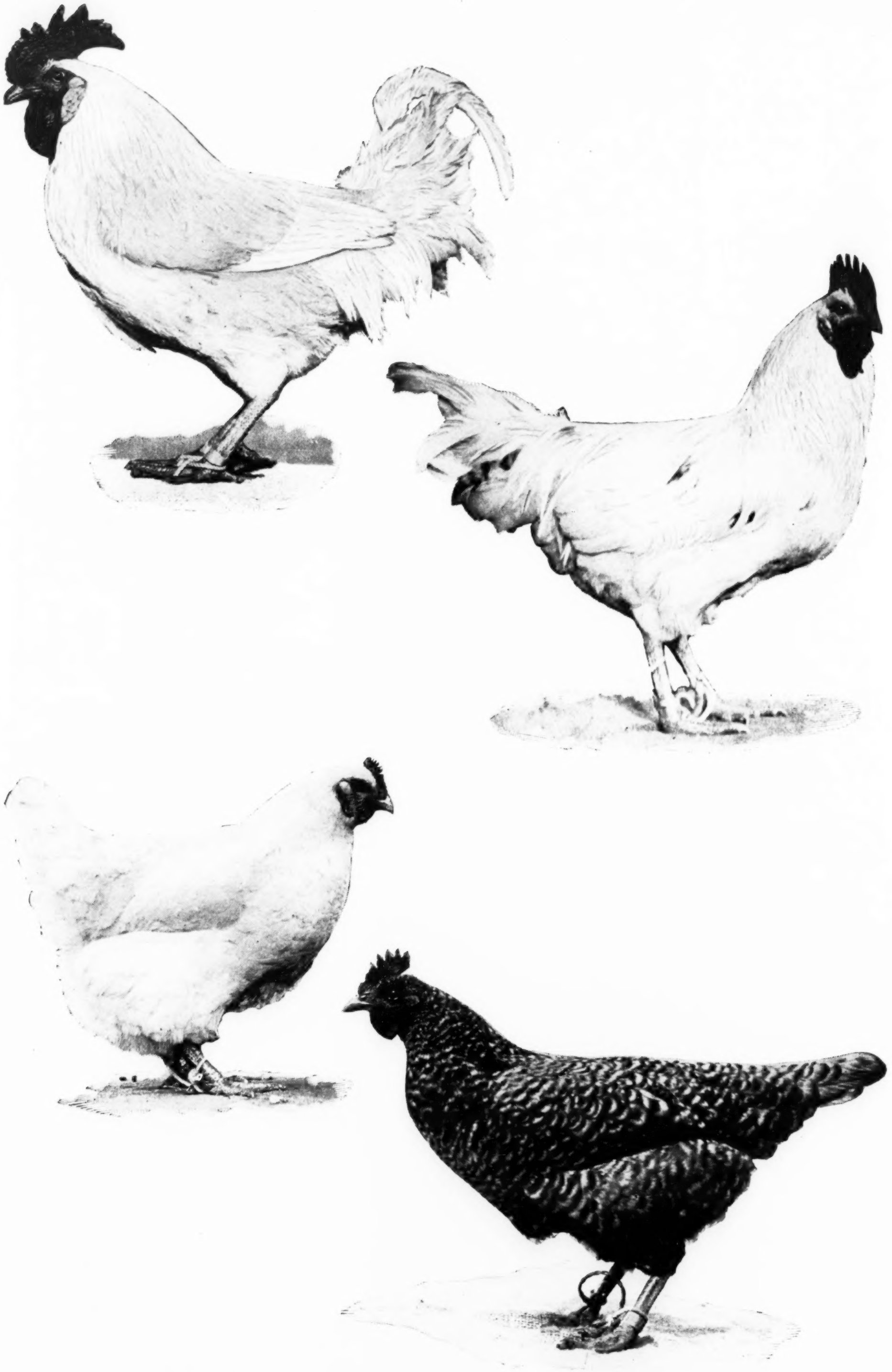


FIG. 1.—Explanation on opposite page.

makes its appearance in F_2? It cannot have come from the Black Hamburg grandparent since we know that in every case where the factor for barring is added to black pigmentation, the barred pattern is brought out. It must therefore have come from the White Leghorn. In other words, the White Leghorn itself carries factors for this barred plumage pattern.

BREEDING BLACK FROM WHITE.

But this is not all. If a White Leghorn male be mated with a White Plymouth Rock or a White Silky female or with any other bird carrying recessive white, the first generation progeny are white, sometimes manifesting on close inspection a few black flecks in the plumage. No colored birds result. Now suppose these F_1 white fowls are mated together. One would naturally expect nothing but whites to result. But this is not the case. Among every sixty-four adult individuals, there appear approximately twelve birds that are dark colored —either barred or black, depending upon the cross used. It may now be asked whence came the black birds in a cross in which the original parents were pure white? In the case of the White Plymouth Rock mating, we know that the White Plymouth Rock parent could not have introduced the black because, whenever a black factor is added to a recessive white carrying the barring factor, the pattern becomes patent and the bird becomes a Barred Rock or "Cuckoo." We are therefore forced to one of two conclusions: (1) Either the White Leghorn parent contributed the black pigmentation or (2) the pigmentation was produced by the conjunction of two factors of which the White Leghorn and the White Plymouth Rock each contributed one. By Mendelian analysis of the experimental results, this question can be answered. It results in this: If one of these factors for black (X) comes from the Leghorn, and the other (Y) comes from the White Plymouth Rock, then the number of dark colored birds in F_2 is nine in sixty-four. If on the other hand, the White Leghorn introduces all the factors necessary to determine black pigmentation in F_2 progeny, the number of dark colored birds would be twelve in sixty-four. In the actual experiments carried out at the Rhode Island Agricultural Experiment Station, among 167 F_2 birds raised from the mating in question, thirty-three were dark colored and 134 were white. The expectation was dark colored, 31.2; white 135.8. It can therefore scarcely be doubted that the White Leghorn male carries in its germ cells all the factors necessary for the determination of black pigmentation in the F_2 generation of crosses with non-pigmented breeds.

THE FACTS EXPLAINED.

Now what is the explanation of these phenomena? It has been stated that the White Leghorn possesses a dominant white. But white in the plumage of poultry is merely the absence of color and the absence of color can scarcely be dominant over the presence of color. It must be assumed therefore that the Leghorn white is due to some positive inhibiting factor (I) which in some way is able to repress or to neutralize the black pigment, not only in its own somatic cells, which would otherwise show black, but also in crosses with other black breeds. When I is present

---

THE WHITE LEGHORN UNMASKED.

(See illustrations on opposite page.)

Although the White Leghorn is considered a "pure breed," it is very far from being a pure breed, from a genetic point of view. Its germ cells even contain a factor for barring, so that barred fowls can be produced from certain matings of pure white fowls. Upper left is a White Leghorn male, which was mated with a White Plymouth Rock female such as is shown in the lower left. From this cross resulted birds like the one shown in the upper right—nearly solid white, but with occasional black splashes. When these birds are bred together, a definite proportion (12 in 64) of the offspring are barred, like the bird shown in the lower right. Further analytic breeding proves that this barring is carried in the germ-plasm of the White Leghorn, not the White Plymouth Rock. (Fig. 1.)

in homozygous condition, black pigmentation is held completely in control; when I is present in a heterozygous condition, as in the F_1 cross-breds, the effect is diminished, and a little black frequently shows as minute flecks in an otherwise white plumage.

This factor for the inhibition of black is apparently present normally in both male and female White Leghorns in homozygous condition, and is not sex-limited in its manner of inheritance. For the barring factor, however, the White Leghorn male appears to be homozygous and the female heterozygous. The presence of these two factors explains many curious results that have been obtained by poultrymen when they have employed in crosses the White Leghorn breed.

But these are not all the factors of interest that the White Leghorn carries in the germ cells but does not show somatically.

If a White Leghorn male be crossed with a White Silky female, the dark mesodermal Silky pigmentation of the beak, shanks and face is reduced in the F_1 cross-breds to an intermediate grade. The plumage of such birds is white, with a few black flecks, and the males resemble the females not only in these points but also in the color of the irides which are lighter than in the Silky parent and sometimes almost as much of a bay as in the White Leghorn itself.

If, however, in a cross of this sort, the male parent is the Silky and the female parent is the Leghorn, the results are different. The males will be found to show little of the Silky pigmentation in beak, shanks, eyes or face, and their plumage is almost a pure white. But the females show the deeper Silky pigmentation in all these structures and the white feathers of the wings and back are heavily splashed with black. Similar results are obtained when the White Leghorn is mated with some other heavily pigmented breeds like the Black Langshan,[1] and when the Brown Leghorn is crossed with the White Silky.[2]

Here then we have to do with another inhibitive factor (I′) which acts (possibly in conjunction with the first inhibitor, I) not only upon the black plumage pigment of ectodermal structure, but also on the deeper mesodermal pigmentation. While the first inhibitory factor mentioned does not appear to be a sex-limited character, this second inhibitor does appear to be correlated with sex. It is transmitted from the male Leghorn to both male and female progeny, but by the female Leghorn it is given to the sons only.

OTHER COLORS HIDDEN.

In addition to these inhibitors of black pigmentation, the White Leghorn also possesses inhibitors for buff and red. These colors are, however, repressed less perfectly than black; and red, as might be expected, less perfectly than buff. Whether the factors that inhibit these colors are identical with the inhibitor of black cannot now be stated. Nor would it be safe to affirm that there are not still other unrecognized factors modifying pattern and plumage color carried by this interesting breed. In any case the above facts are sufficient to show that the White Leghorn is something of a masquerader. Her appearance gives us little knowledge of what lies beneath her cloak of white. And if the White Leghorn, after a little study of her constitution, gives us such new conceptions of her character complex, what shall we expect of some other breeds, of which we still know comparatively nothing?

What the poultry world of today needs, in addition to the Standard which tells how poultry ought to appear is a Standard which will tell *how the varieties ought to breed*. It would be a great help to poultry breeders if each different breed should have its zygotic constitution represented by a formula designating, so far as possible, all the important characters possessed by that breed, thus indicating the breeding values. For instance, in the case of the White Leghorn the following symbols might be used to cover the characters already mentioned.

---

[1] *See* Lewis, H. F. Jour. of the Amer. Assoc. of Instructors and Investigators of Poultry Husbandry, Vol. 1, No. 2, 1915.

[2] *See* Bateson, Wm. and Punnett, R. C., Jour. Genetics, Vol. 1, No. 3, 1911.

F = femaleness
N = black pigmentation
B = barring factor
I = inhibiting factor No. 1
I′ = inhibiting factor No. 2

and the constitution of the male written

$$f_2N_2B_2I_2I'_2$$

while the White Leghorn female being heterozygous for three factors would be

$$FfN_2BbI_2I'i'.$$

Using these same symbols, the White Dorking, another dominant white breed, but lacking both the latent barring and black would become, male,

$$f_2n_2b_2I_2i'_2$$

and the female essentially the same,

$$Ffn_2b_2I_2i'_2$$

The White Plymouth Rock, a recessive white, which differs from the White Leghorn only in the lack of the factors for black pigmentation and for the inhibitors I and I′, would be represented, male

$$f_2n_2B_2i_2i'_2$$

and the female

$$Ffn_2Bbi_2i'_2$$

The White Silky with its black mesodermal pigmentation (M) would be, male,

$$f_2M_2n_2b_2i_2i'_2$$

and the female

$$FfM_2n_2b_2i_2i'_2.$$

These illustrations are sufficient to indicate what is meant by standardizing breeds of poultry. Of course the breeds alluded to above have many other characters that would also be listed in the Standard formulae, and other breeds would possess their own character-complexes, or aggregations of unit characters. But the main point is, that if breeds were so standardized, and listed, a poultryman would know what he was purchasing when he acquires a certain fowl. He would know not only how the bird looked, but how that bird will breed; and it seems as if this point might be of interest and possibly of importance to poultrymen who are also poultry breeders.

Plant Breeding Correlations

Fundamental principles useful in apple breeding are being studied particularly at the Iowa state agricultural experiment station. One object is to determine what features are of taxonomic value in distinguishing horticultural varieties with certainty; another is to find correlations which may be used in practicing intelligent selection with young seedlings without having to grow each plant through to maturity in order to determine its characters. A large factor in the success of most great plant breeders has been their marvelous ability to judge by looking at a small seedling, what it would be likely to produce when it reached maturity. This ability has often seemed mysterious, but as a fact it must necessarily depend largely on the observation of correlations not appreciated by the ordinary horticulturist, and perhaps not definitely formulated by the talented breeder himself. The Iowa station wants to reduce this mystery to mathematical formulae and put it in the reach of every one of intelligence; already hardiness has been found to be correlated with structure and composition in a definite way.

Johannsen to Visit America

Dr. W. Johannsen of the University of Copenhagen, Denmark, is expected in the United States this summer to join the faculty of the University of California Summer Session at Berkeley. He has been invited to attend the meeting of the American Genetic Association at Berkeley, August 2-7. Dr. Johannsen is one of the pioneers in the application of mathematics to biological problems, and is particularly well known in genetics for his enunciation of the theory of "pure lines."

INFLUENCE OF STOCK ON CION

In Grafted Trees, One Parent Usually Modified, Sometimes Both—Explanation of the Changes—Remarkable Almond Grafts in California.

B. S. BROWN

Professor of Pomology and Plant Breeding, University of Maine, Orono, Me.

MUCH has been said in recent years regarding the effects of graftage upon the co-joined parents. That there is a very decided difference in certain fruits when grafted upon different stocks no one will deny. But to what extent these influences represent fixed or dependable characters is still an open question.

The best recognized example of reciprocal influence is the dwarfing of certain standard fruits when grafted upon smaller stature plants. Thus pears are put upon quince or apples upon doucin or paradise stock[1] for this purpose. While slow-growing stocks tend to reduce the stature of plants grafted upon them, the converse of this is also true, that rapid-growing stock will stimulate the growth of naturally dwarf plants. While quince stock will reduce the size of a pear tree, a pear stock will increase the stature of a quince that is worked upon it. This is not only true in the above relation but also where conditions are reversed. That is, pears grafted on quince stock will stimulate greater root growth to the quince. Another oft-cited example of this same condition is the influence of standard apples when grafted on stock of the Siberian Crab. Such a union always stimulates the root system of the stock to a larger size than it would grow naturally.

Because of the commercial importance of the subject, growers of all kinds of fruit are now attempting to find out definitely the reciprocal influence of various kinds on each other. One of the interesting experiments is that made by grafting tomato on belladonna, when analysis showed that the tomatoes borne contained an alkaloid allied chemically and physiologically to atropin, whereas tomatoes do not normally contain any such substance.[2]

The California agricultural experiment station has been conducting a series of experiments to determine the exact results in various grafts on citrous fruits. One of the interesting results, which may serve as a specimen of many, is that when lemons are budded on the hardy, savage, Japanese, three-leaved species (*Citrus trifoliata*), they are dwarfed, and the diameter of the trifoliate stock, below the bud union, is nearly always increased.[3]

While investigating the almond industry in Central California recently, I discovered a peculiar case of reciprocal influence of stock and cion, to which it may be of interest to call attention. An orchard of 10 acres had been set to peaches and then a year later top-worked to almonds, the union being made just above the ground. The orchard had been in existence for 42 years and contained many trees as sound as they were at the age of five.

Many of these trees were 50 feet high and ranged from two to three feet in diameter. Figures two and three are individual trees in this orchard, showing the peculiar enlargement at the point

[1] Doucin and Paradise are types of wild apple, probably of central Asian origin, which are widely grown for stock on which to bud cultivated varieties of apple. In the past they have been considered distinct species but at present are held rather to be trade names, each one embracing 10 or a dozen varieties of the ordinary apple. Doucin stock is used when "semi-dwarf" trees are wanted, while the use of Paradise stock results in a still greater reduction of size.

[2] See Gardeners' Chronicle, London, May 16, 1914.

[3] This was pointed out 10 years ago by H. H. Hume (Citrus Fruits and their Culture, 1904) and is true of all species and varieties that have been tested on trifoliata stock.

UNION OF ALMOND AND PEACH

This graft is 42 years old and seems to have stimulated both of the parents, since each of them has attained a size which would hardly be expected if it were growing alone. The increased vigor is seen not only in the size, but in the great longevity. Grafted trees are frequently short-lived. (Fig. 2.)

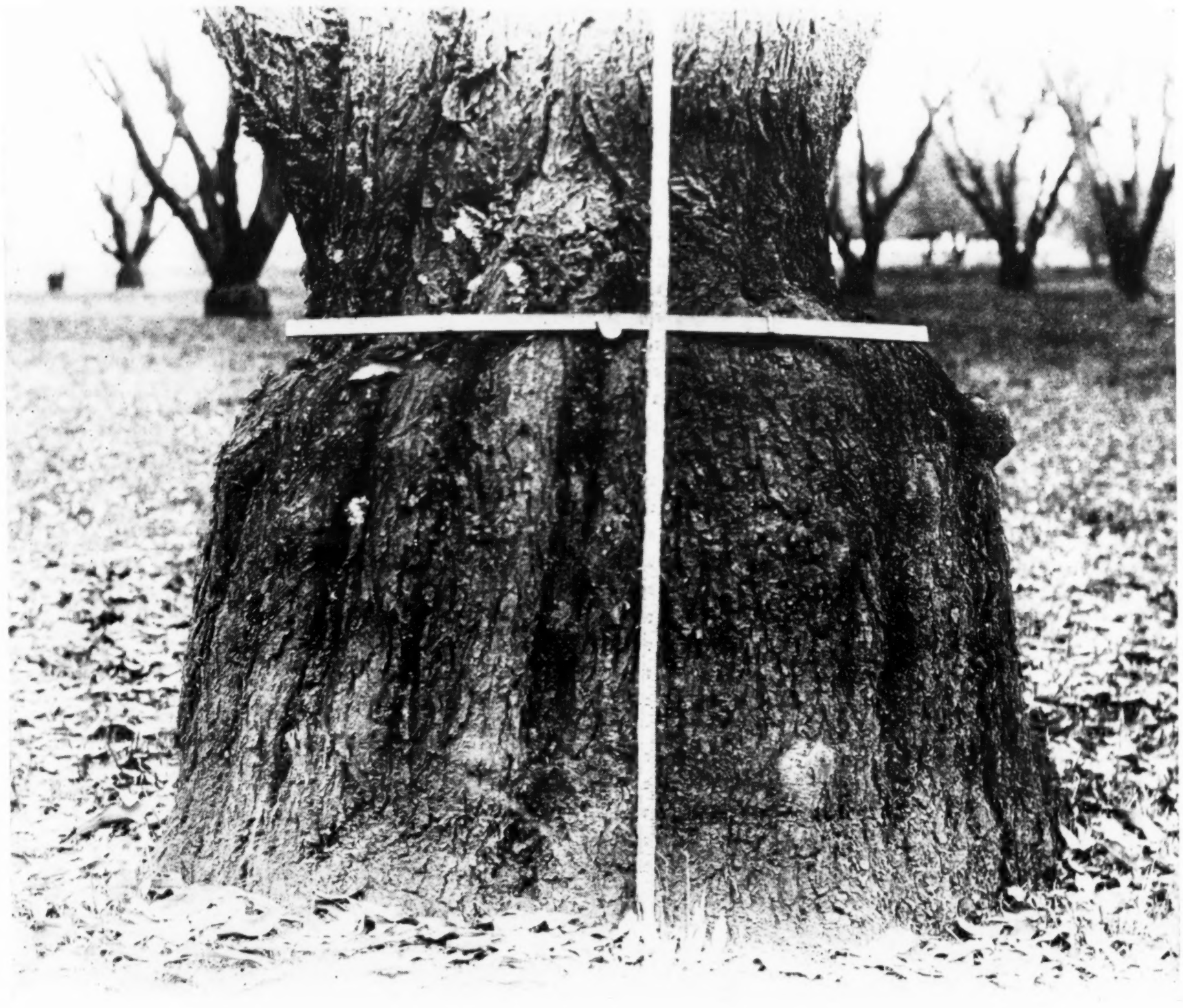
of union of the peach and almond. The larger one (Fig. 2) measures 9′ 1″ in circumference above the union and 10′ 4″ below. The second one (Fig. 3) measured 6′ 6″ above and 9′ 7″ below, making a difference of 3′ 1″ in circumference. In peculiar contrast to the above the same orchard had four rows on the west side grafted on plum stock. These were presumably of the same age, but were from one-quarter to one-half smaller than those on peach root. All but ten had died and been removed while those still living were sickly and contained many dead branches. The plum stock was in every case smaller than the part above the union. Fig. 4 shows one of the trees on plum stock, which measured four feet in circumference below the union and 4′ 10″ above, a decided contrast to the peach stock. The same condition was also observed in other old orchards of similar age.

The union that the peach makes with the almond is exceedingly strong, and usually the peach remains sound longer than the almond. Fig. 5 shows a photograph of a vertical section cut through the union. The line of growth is straight across and very sharply defined.

The section in the center of the picture is a cut through the union of an English walnut and a black walnut, differing from the almond illustration in that the union was made by budding instead of grafting.

From these almond grafts, it will be evident that grafting may increase the size not only of one parent, but of both; and in this case, it seems to have resulted in increased longevity, as well.

Another influence of stock over cion

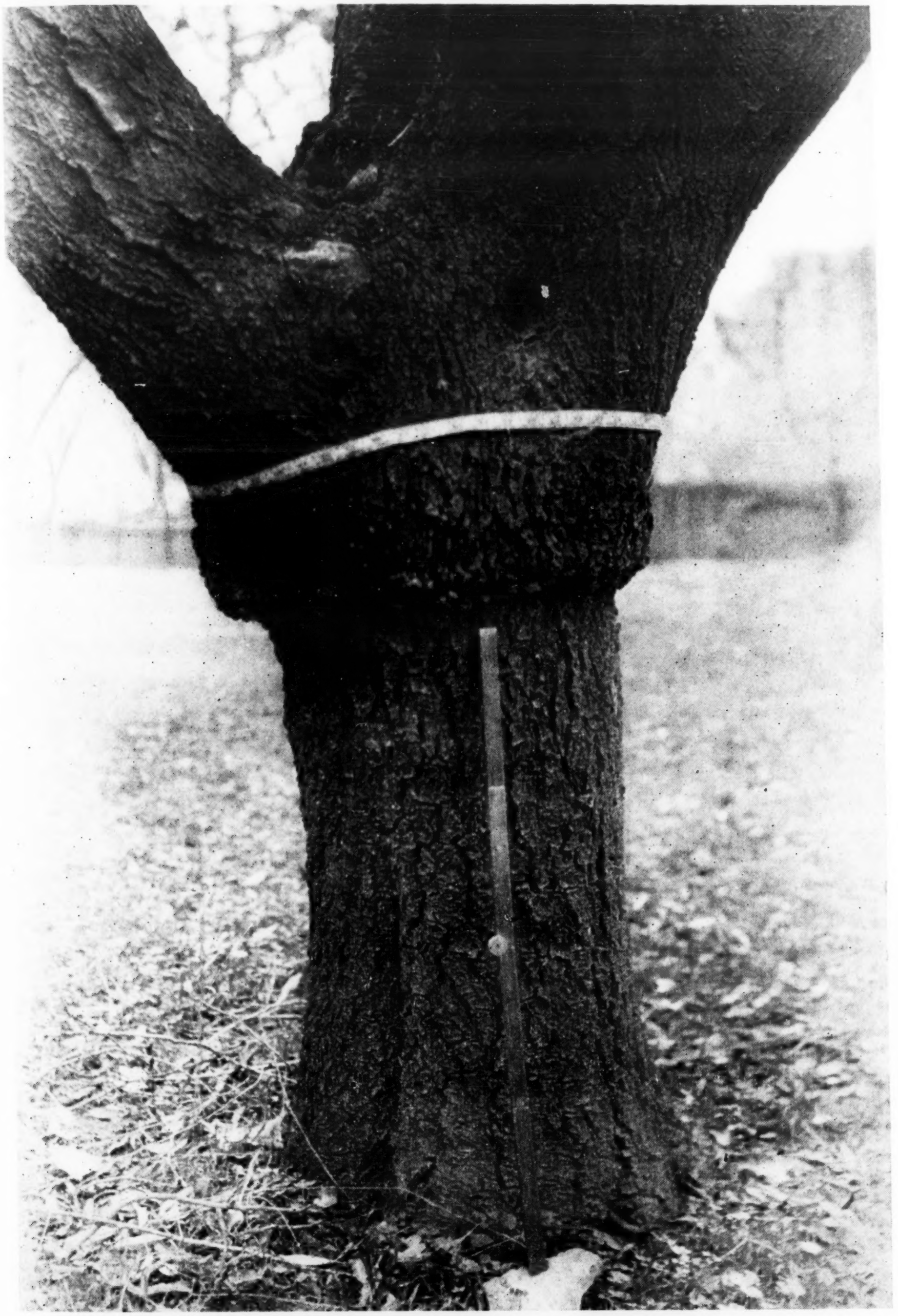


AN UNUSUALLY FAVORABLE GRAFT

The union of peach with almond is exceedingly strong. In the case of this 42-year-old tree, it is still absolutely sound. Both the stock or root parent, and the cion or top parent, seem to have been stimulated to unusual growth, and this evidently caused an increased flow of sap, which may be responsible for the splendid condition of the tree. (Fig. 3.)

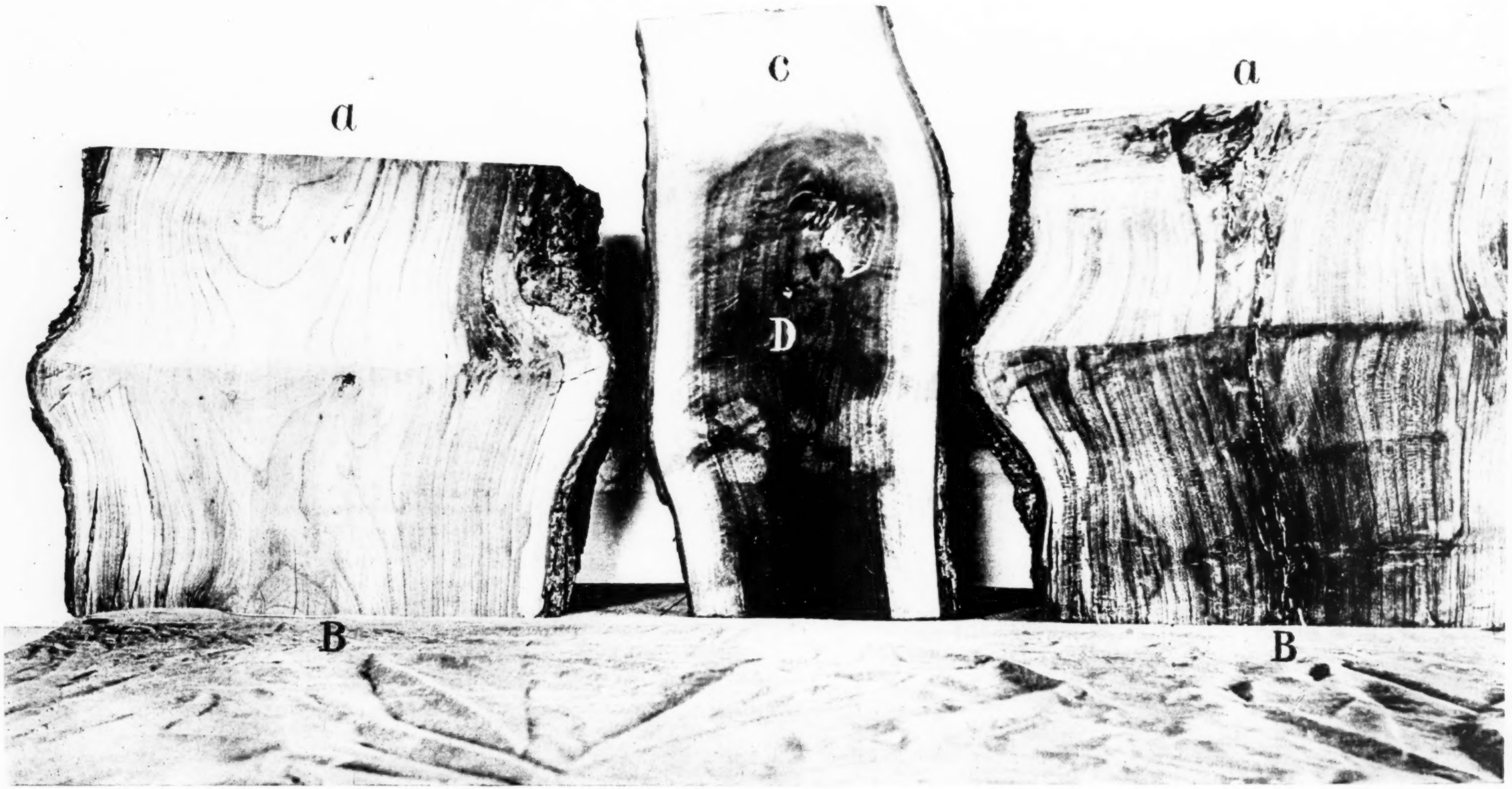
is the early bearing tendency of dwarfed trees. Orchardists everywhere recognize this factor and utilize it in a practical way. Pears on quince stock fruit in three or four years while the standard stock requires from five to eight. Apples on paradise stock will fruit in three years while the same variety on French crab will require from five to eight years. In almost every case this early bearing habit is associated with the dwarfing condition and the two seem to bear a fairly permanent correlation. Also in this same connection it is well to note that dwarfed trees are shorter lived than their full statured relatives. This is well illustrated in Figure 4 where the almond was grafted on plum stock.

Various other known conditions are attributed to this reciprocal influence of grafts, for example, the delay in the blooming period of certain fruits when united with slow growing stocks. Five years ago in one of the sub-stations of the University of California was begun an experiment with almonds to prove this point. It so happens that the almond is the earliest blooming deciduous fruit on the Pacific Coast, blossoms appearing from five to eight days ahead of the peach and from 10 to 14 days prior to most plums. Desirable types of almonds were grafted on both peach and plum stock and their influence on the resulting bloom noticed. Peaches produced little or no noticeable effect while the plum stock retarded the



THE GRAFT OF ALMOND ON PLUM

In this 42-year-old tree, the almond cion has grown well but the plum stock has lagged behind. It was, therefore, unable to furnish as great a supply of sap as the more vigorous top demanded, so most of the trees of this sort, in the orchard seen by Mr. Brown, had died or were dying. (Fig. 4.)



CROSS-SECTIONS OF GRAFT UNIONS

At the sides are transverse and tangential sections through the graft of almond on peach, (a) being the almond cion and (b) the peach stock. The great firmness of the union is noticeable. In the center is a cut through the union of a Black walnut (d) on which an English walnut (c) was budded. (Fig. 5.)

bloom from five to seven days or about half the original difference between the two on their own roots.

Color and flavor of fruits is also influenced more or less by the stock used, but the results are not so easily measured or as well understood. There apparently is no question but that high colored fruits can be improved by grafting upon seedlings grown from high colored fruits. This, however, is more or less of an indefinite quantity, as the seedlings themselves may vary widely in their ability to transmit the high color. Results are more noticeable when seedlings from Siberian Crabs are used, because they are more stable.

What is true of color is also true of the sugar and acid content of the fruit.

Apples low in sugar when grafted upon sweet apple trees will show an increase in sugar content. Undoubtedly some of the poor quality and lack of color in certain regions, attributed to local environment, may be due to the influence of the stock on which they are grafted.

The cause of these varied influences may be attributed to two sources—namely, mechanical and physiological disturbances. This can be more easily understood when we think of the cell as being the plant unit. Each cell performs its own functions. Theoretically the cells of the stock perform all those functions characteristic of the stock, up to the point of the union. Then the cells of the other co-parent take up the work and modify the nature of this work —*i. e.*, the vital processes—in accordance with their own peculiar character. While there is a rather wide division of labor in the functioning powers of the cells of the different organs, there is a more or less definite protoplasmic organization throughout the entire plant tissue. Certain cell substances such as sugar may be differently affected by the cells of each of the co-parents. If the cells of the stock are capable of developing a higher sugar content than the cion, presumably the cells of the latter will not reduce it, hence a decrease or increase in the acid or sugar content is influenced by the stock. Of course this is relatively a very small amount. But if it were not for this, the entire purpose of graftage would be lost.

In the case of dwarfed stock the cause is more mechanical. The root system of the slow growing plant is incapable of supplying sap as fast as the more rapidly growing top demands, hence a reduction in size. Conversely, the demands of the actively-growing top stimulate the root system to a greater effort, and thus cause an increase in the size of the stock, as in the photographs here shown.

The early bearing habit of dwarfed trees may be explained on the theory that the diminished supply of sap tends to weaken the whole tree. Now the object of every plant, one may say, is to reproduce its kind; and when it finds itself weakening, it seems to hasten this process of reproduction, in order to make sure that it may leave progeny before it dies. The dwarfed—and weakened—tree thus blossoms and sets fruit before its normal mates; and it is correspondingly shorter lived, due to this weakening, in consequence of the mechanical restriction of the food supply.

Redfield Offer Remains Open

At the request of the council of this Association, Casper L. Redfield has consented to let his offer for data regarding the results of early marriage, stand open for another year, or until December 31, 1915. It will be recalled that when the original offer terminated on December 31, 1914, the council decided that none of the evidence submitted met the stipulations. As the question of early marriage is one of fundamental importance to eugenics, the council felt that a prolongation of the offer might stimulate public interest in the subject and lead others seriously to study it.

EDUCATION AND RACE SUICIDE

Women's Colleges Have Heavy Responsibility for Disappearance of Old American Stock in the United States—Reforms That Are Needed.

ROBERT J. SPRAGUE
Professor of Economics and Sociology, Massachusetts Agricultural College, Amherst, Mass.

DURING the twenty-five years from 1887-1911 the deaths among the native born population of Massachusetts exceeded the births among the native born parents by an aggregate of 269,918.[1] During the same period the total births in families having foreign born parents exceeded the total of deaths by 526,987.

The native and foreign birth rates within the Commonwealth have been as follows:[2]

	1890	1900	1910
Native birth rate per 1,000 native born population..	12.7	11.7	14.9
Birth rate among foreign born parents per 1,000 of foreign born population.	38.6	42.6	49.1
Native death rate per 1,000 native born population..	19.9	18.7	16.3
Death rate of foreign born per 1,000 of foreign born population.....	17.5	16.6	15.4

I have no desire to hold up Massachusetts as a horrible example of a State committing race suicide. Conditions may be just as bad in other industrial and commercial populations, but unfortunately other States have not been wise enough to collect adequate data on these points, whereas the Bay State has led off for many years with a most efficient and commendable system of vital statistics.

If this apparent deficit of native births and the surplus of foreign births are true to the facts, and if they should be maintained for a number of generations, the writing on the wall is clear, and he who runs may read the fate of the Anglo-Saxon stock in every activity of Massachusetts life; and if the conditions in this Commonwealth are typical of American industrial populations generally, then it is a National as well as a local problem that faces us.

How many children must each child-bearing woman, on the average, bring forth in order to sustain the present population, not providing for any increase?

Let us start with 200 living babies of native stock, of which 103 will on the average be boys and ninety-seven girls, due to the fact that nearly 6 per cent. more boys than girls are born. By the time the girls become twenty years of age at least nineteen will have died, leaving seventy-eight as possible wives.

It is a little uncertain to say how many of this seventy-eight would not marry, but I have a few data from which to get a general estimate.

In a selected New England village in 1890 there were forty marriageable girls between the ages of 20 and 35. Today thirty-two of these are married, 20 per cent. are spinsters.

An investigation of 260 families of the Massachusetts Agricultural College students shows that out of 832 women over 40 years of age 755 or 91 per cent. have married, leaving only 9 per cent. of spinsters. This and other observations indicate that the daughters of farmers marry more generally than those of some other classes.

In sixty-nine (reporting) families represented by the freshman class of Amherst College (1914) there are 229 mothers and aunts over 40 years of

[1] These aggregates are computed from the annual reports of "Births, Deaths and Marriages" issued by the Secretary of State.

[2] These statistics are computed from the U. S. Census Reports.

age, of whom 186 or 81 per cent. have already married.

It would seem safe to conclude that about 15 per cent. of native women in our general American society do not marry during the child bearing period. Deducting 15 per cent. from the seventy-eight possible wives leaves sixty-six probable wives. Now among the native wives of Massachusetts 20 per cent. do not produce children, and deducting these thirteen childless ones from the sixty-six probable wives leaves fifty-three probable, married, child-bearing women, whose duty it is to reproduce the original 200 individuals with which we began this study, or an average of 3.7 children for every married woman who demonstrates any ability to bear offspring.

According to these probabilities, every married woman bearing children must bring three to maturity, or to a marriageable age, in order to prevent the race from actually declining in numbers.

Under the present practices this would seem to be the minimum, because no account has been taken of those who are not marriageable on account of insanity and other incapacitating troubles.

THE SCHOOLS AND RACE SUICIDE.

The causes of race suicide in some parts of America are "numberless as the sands on the seashore," but I will discuss at length only the relation of higher education to it.

Too small a birth rate leads to race extinction, and too great a birth rate is the next greatest folly, since it may precipitate not only a domestic but a world problem. The great German birth rate is the natural force behind the present war. Too large a family is liable to cripple and stunt the higher life of both parents and children, and too small a one leads to lack of virility in both individuals and race.

The attitude of the schools towards the interests of the race merely reflects the general ideals and feelings of society and the immediate managers of these institutions should not be held unduly responsible for the failure of the schools and colleges in the past to prepare the new generations for their living needs and racial responsibilities.

Until recently the high schools of the whole country turned their backs on the family and failed to recognize the vital interests of this most fundamental institution; they tried to prepare our children for college, for the parlor, club and travel, but did not recognize the demands of the workshop, kitchen and nursery where the greater part of the average parent's time and energy must be spent. First in reform came the introduction into education of office work, and finally will come the preparation for the revitalized home life and race survival.

The former old public school ideals of the white collar, the white dress and helpless hands have sent thousands of boys into hopeless bachelor jobs and just as many girls into sterile school teaching and other nice, clean occupations where their blood might dry out of the race.

The former lack of opportunity in America for universal, efficient, vocational education has filled our roads with tramps, our prisons with young men, our brothels with young women, and the poorhouses with the aged of both sexes. These things, however, are changing in the public schools all over the land, and the common cry is to bring the school system down to the needs of actual life, earning power and efficiency in shop and home.

Home making and child rearing is the greatest job of life and calls for every resource of brain, hand and heart; anything which detracts from their normal development is an evil, because nothing can substitute for them in importance.

THE WOMEN'S COLLEGES.

The classical college education for women without any doubt develops a high type of character and independence in the graduates as individuals, and such a training might be desirable for all girls that can afford it, if certain vital interests of the race and its future were taken into account. The standards of the home, school and office are all elevated when college graduates

enter them, but how about the vital future of the race?

Is the woman's college as now conducted a force which acts for or against the survival of the race which patronizes it? Whatever intellectual and moral superiority a race may have, it needs also a certain amount of reproductive impulse in order to remain on the earth. No culture, art, science or morality can save it unless it produces about three matured children per married, child-bearing couple, and any race which does not do this is doomed to extinction. If we have forces which are drawing off the best blood of the American stock and sinking it in a dry desert of sterile intellectuality and paralytic culture, let us know the facts, and let these magnificent colleges face them and the race responsibilities involved, because without any doubt, all of our great educational institutions can and will become powerful agencies for race survival rather than race suicide when their wealth and influence become applied along the right lines. The work to be done is not a criticism and reform of the colleges alone, but a change in the ideals and race feelings of the types of people that are represented in these institutions.

Reliable statistics can be obtained from only a few of the institutions granting college degrees to women. Those mentioned below have collected data concerning their alumnae and have made them accessible for the purposes of this paper.

It would be interesting to compare the effects of the education of women in the great coeducational institutions with the results tabulated below from the exclusive women's colleges; but no data are available for such a comparison. Either the coeducational institutions have given no attention to the matter, or they are too young for their results and tendencies to be discernible.

MT. HOLYOKE COLLEGE.

Mt. Holyoke College, the oldest great college for the higher education of women in this country, has collected some interesting statistics on the marital tendencies of its graduates.[3]

Decade of Graduation	Per Cent. Remaining Single	Per Cent. marrying	Children per Married Graduate	Children per Graduate
1842—1849	14.6	85.4	2.77	2.37
1850—1859	24.5	75.5	3.38	2.55
1860—1869	39.1	60.9	2.64	1.60
1870—1879	40.6	59.4	2.75	1.63
1880—1889	42.4	57.6	2.54	1.46
1890—1892	50.0	50.0	1.91	0.95

Professor Hewes estimates from these facts that 41.9 per cent. of Mt. Holyoke graduates ultimately marry.

BRYN MAWR COLLEGE.

From 1888 to 1900 Bryn Mawr graduated 376 alumnae and up to January 1, 1913,[4] 165 or 43.9 per cent. of these had married. Up to that date these alumnae had given birth to 138 children, or an average of .84 of a child per married alumna, or .37 of a child per graduate in all classes up to 1900. Only 32.8 per cent. of all graduates up to January 1, 1913, had married up to that date.

VASSAR COLLEGE.

A compilation of the data given in the "Fourth General Catalogue of the Officers and Graduates of Vassar College" yields the following aggregates and percentages.

[3] Published by Prof. Amy Hewes of Mt. Holyoke College in the reports of the American Statistical Association.

[4] See "Statistics of Bachelors of Arts of Bryn Mawr College," published by the Administration.

CLASSES FROM 1867 TO 1892.

Number of graduates	959
Number that taught	431 (45 per cent).
Number that married	509 (53 per cent. of all graduates).
Number that did not marry	450 (47 per cent).
Number that taught and afterward married	166 (39 per cent. of all who taught).
Number that taught, married and had children	112 (67 per cent. of all who taught and married).
Number that taught, married and were childless	54 (33 per cent).
Number of children of those who taught and had children	287 (1.73 children per family).
Number of children of those who married but did not teach	686 (2 per married graduate that did not teach).
Total number of children of all graduates	973 (1 child per graduate).
Average number of children per married graduate	1.91
Average number of children per graduate	1.0

CLASSES FROM 1867 TO 1900.

Number of graduates	1739
Number that taught	800 (46 per cent).
Number that married	854 (49 per cent).
Number that did not marry	885 (51 per cent).
Number that taught and afterward married	294 (31 per cent).
Number that taught, married and had children	203 (69 per cent. of all who taught and married).
Number that taught, married and were childless	91 (31 per cent).
Number of children of those who taught and had children	463 (1.57 children per family).
Number of children of those who married but did not teach	1025 (2 each).
Total number of children of all graduates	1488 (.8 child per graduate).
Average number of children per married graduate	1.74 per married graduate.
Average number of children per graduate	0.8

WELLESLEY COLLEGE

The data concerning Wellesley graduates are not as complete as might be desired, but Miss Caswell, the Secretary to the President, reports the following statistics.

Classes	Number of Alumnae	Number Married	Per Cent. Married	Number of Children	Number of Children per Married Graduate	Children per Graduate
1875–1889	528	265	50%	438	1.65	.83
1890–1912	3927	1213	31%	1287	1.06	.33
Total.....	4455	1478	33%	1725	1.17	.39

Women are the capital of the race. The farmer that uses his land for golf links and deer preserves instead of for crops has but one agricultural fate; so the civilization that uses its women for stenographers, clerks and school teachers, instead of mothers, has but one racial fate.

A FEW PERTINENT POINTS.

The space given to this paper is not sufficient for much discussion of the causes of and remedies for the situation presented by these statistics, and it might not be well to enter into that anyway; but I will mention a few points that seem important.

1. There is needed throughout the nation a campaign of public education through church, school, and legislation, to strengthen the ideals and economic foundations of the family. Our education has glorified individualism and our tax system has steadily penalized the man with a family. The opportunities for social legislation in laying a better foundation for the family and ultimately the race are unlimited. Such a development would be reflected in the new aims

and methods of schools and colleges. Public opinion must be created by our leaders of literature and thought both without and within the educational institutions, and it is high time that this line of action is pushed to results, before the best blood of the American people becomes dried out of the race.

2. More strong men are needed on the staffs of public schools and women's colleges, and in all of these institutions more married instructors of both sexes are desirable. The catalogue of one of the colleges referred to above shows 114 professors and instructors, of whom 100 are women, of whom only two have ever married. Is it to be expected that the curriculum created by such a staff would idealize and prepare for the family and home life as the greatest work of the world and the highest goal of woman, and teach race survival as a patriotic duty? Or, would it be expected that these bachelor staffs would glorify the independent vocation and life for women and create employment bureaus to enable their graduates to get into the offices, schools and other lucrative jobs? The latter seems to be what occurs.

3. Some people are advocating coeducation as a solution of these difficulties, but we cannot now make assured statements on that matter, because there are not sufficient data available for final conclusions, and time only can show the effects of the coeducational institutions of the other parts of the country. If by coeducation we merely enable the women to get a man's education and prepare for a man's work, then certainly this is not a full solution, even though the environment of college life would be more normal and lead to some marriages.

4. Women college graduates are not greatly sought after as mates, to share in the work of getting a living and founding a family, because they are not prepared psychologically and technically for the jobs of cooking, sanitation, nursing and child rearing, and are not seeking that mode of life except under specially selected conditions. They have culture and intelligence and demand high standards in husbands and homes, but they are not prizes in the matter of efficiency in domestic life. The principles of supply and demand are effective in this as in other things. If college women could combine their culture with domestic ideals and efficiency there would be a higher demand for them as helpmeets and mothers of the new generation. The American people as a whole have idealized individual independence in both men and women, instead of the family which must be the fundamental basis of race survival, and as long as we maintain that attitude our race suicide statistics will be portentous.

Lectures in Eugenics

At the request of the Young Men's Christian Association of Washington, the American Genetic Association arranged a course of public lectures on eugenics which has been largely attended. The speakers secured were the following: Feb. 4, Alexander Graham Bell on Heredity and Marriage; Feb. 11, Paul Popenoe on the History of the Eugenics Movement; Feb. 18, Dr. L. E. Cofer, assistant surgeon general, U. S. Public Health Service, on the Relation of Immigration to Eugenics; Feb. 25, G. N. Collins, Bureau of Plant Industry, on How Heredity is Measured; March 4, Roswell H. Johnson, University of Pittsburgh, on the Young Man and Marriage; March 11, Alexander Johnson, the Training School, Vineland, N. J., on Feeblemindedness; March 18, Dr. Elnora Folkmar on Negative Eugenics and Racial Poisons; March 25, Paul Popenoe on Heredity vs. Environment; April 1, Paul Popenoe on the Birth Rate; April 8, Daniel Folkmar of the Bureau of the Census on the Evolution of Man.

A DENT IN THE FOREHEAD

CHARLES B. DAVENPORT

ONE of the most striking phenomena to a student of heredity is the definiteness with which certain small, apparently insignificant, peculiarities are inherited. This is very prettily illustrated again by a case which a correspondent has sent to me and, although the family history is only a fragment, it is so instructive as to be worth publishing.

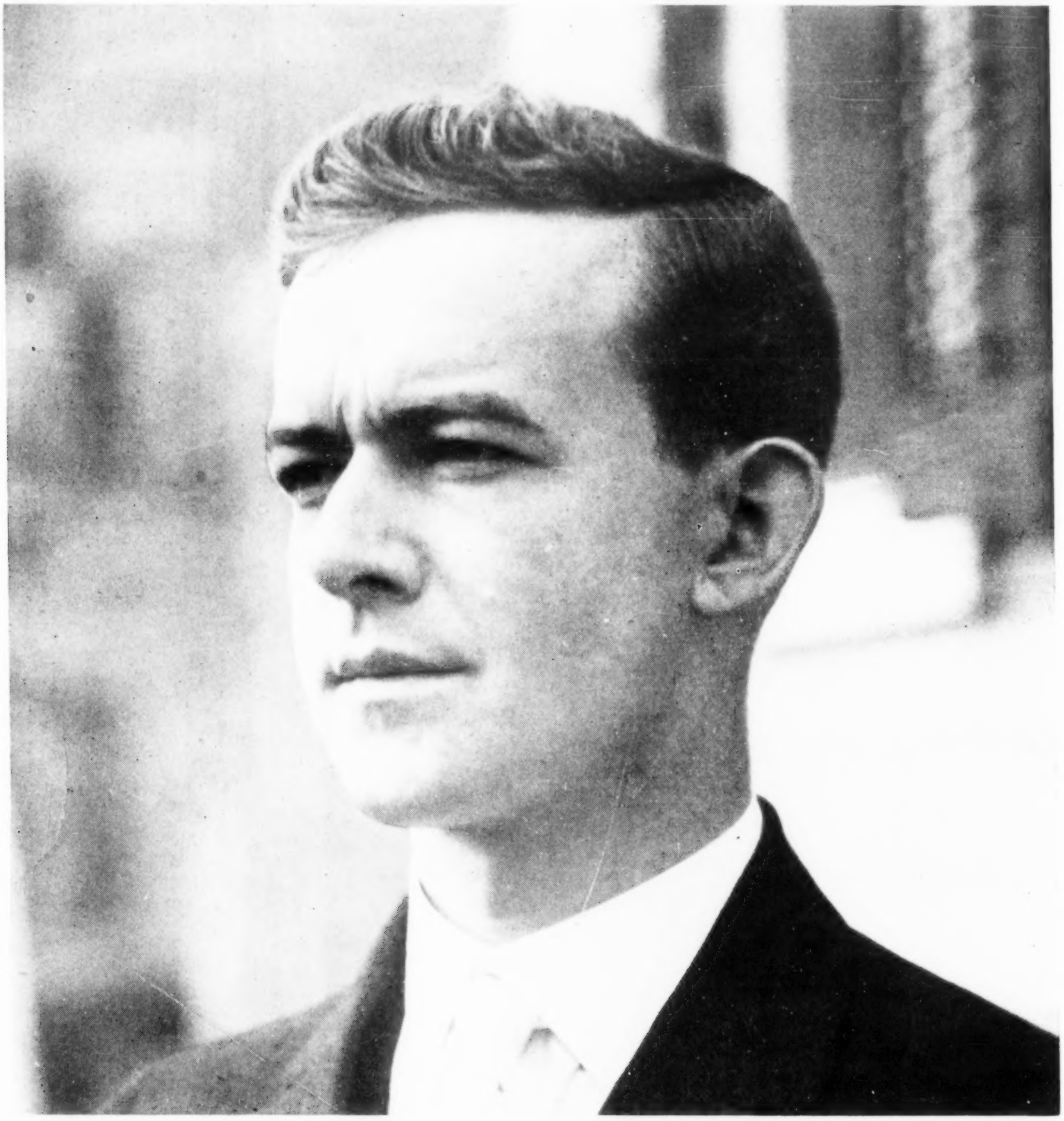
The trait in question consists of a small depression in the sagittal plane of the frontal bone, extending two or three centimeters above a line joining the upper limits of the orbits. The depression is a striking one, but the morphological changes involved do not seem to be great. Nevertheless they are very persistent in the family history and without doubt indicate a definite modification of the germ plasm which is, in accordance with the modern interpretation, of the positive, dominant sort; that is, due to the addition of a gene.

We start with a fraternity of three grown children, born between 1885 and 1890 (III, 20-23). The first, a male, has a deep dent in his forehead, as if his skull were pushed in. This is the young man whose photograph is presented herewith (Fig. 6). The second, male, has a deep crease or dent in forehead and the third, female, has a crease in forehead. A fourth member of the fraternity was a small boy who died at the age of nine months and of whom we have no description. The *father* of this fraternity of three (II, 15) had a dent in the forehead. The *mother* (II, 14) was unrelated to the father and none of her relatives had a peculiarity of this sort. By another wife the father had one daughter (III, 24) who, likewise, had the crease in the forehead. As this other wife was unrelated and did not show the crease in the forehead, this portion of the pedigree, alone, is sufficient to suggest strongly that the positive trait is carried in the germ plasm of the father.

The father was one of a fraternity of seven, three males and four females. One of his brothers (II, 5) showed the same crease in the forehead. The other did not. Three of the sisters certainly have shown the crease in the forehead. One of these is married and had six children, one boy and five girls, and of these girls three show the crease in the forehead (III, 3-8). Of the fourth sister of the father, long since dead (III, 7), there are no precise data. In response to an inquiry my correspondent has examined a group photograph in which the sister appears and replies: "It is impossible to be sure, but I think there was a slight trace of it from what I could see." This fourth sister has had four children (by three husbands), and one (a son) shows the crease in the forehead. The single member of the second generation who lacks the family trait has two children, neither of whom has the trait; however, the same is true of the two children of his sister (II, 1) who has the trait. Unfortunately definite knowledge is extant concerning two generations only. The conditions in the grandparents are unknown. So far, then, as our information goes it indicates that this slight family peculiarity in the form of the frontal bone of the skull is inherited as a dominant trait.

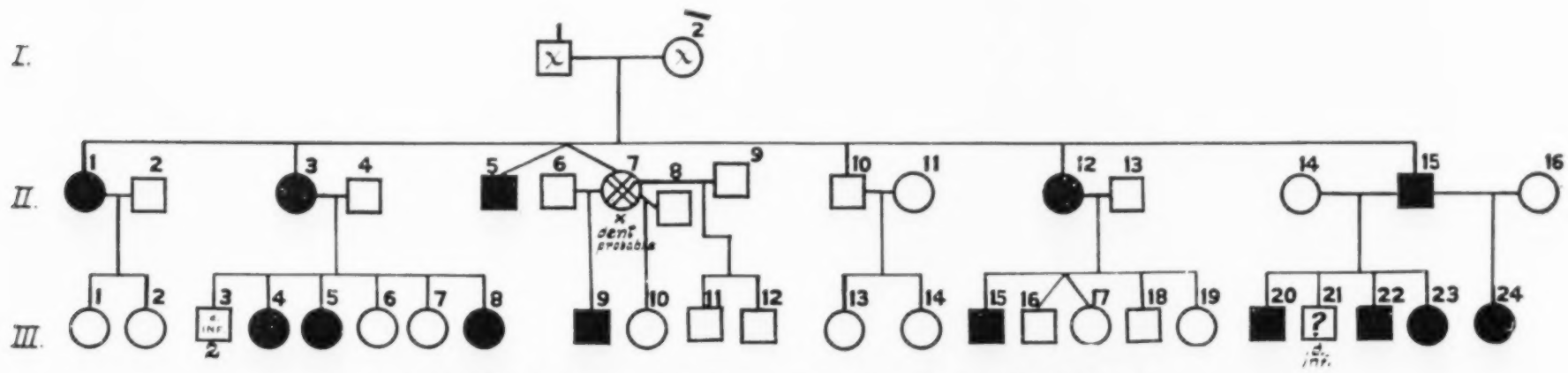
In conclusion the writer wishes first to thank Miss Rose M. Dawson for her coöperation and, second, to request those in whose family such (or other clearly marked) peculiarity in the form of the skull, appears, or who know of such a family trait among their acquaintances, to communicate the fact to him.

Carnegie Institution of Washington, Station for Experimental Evolution, Cold Spring Harbor, Long Island, N. Y., Jan. 30, 1915.



A HERITABLE DENT IN THE FOREHEAD

This young man is shown as III, 20, in the pedigree chart below. The dent in his skull is located in the median line of the forehead, at the upper end of the frown, and because of the illumination is much less conspicuous in the photograph than in real life. From a photograph copyrighted by Brown and Dawson. (Fig. 6.)



PEDIGREE CHART OF THE X FAMILY

Distribution of the dent or depression in the forehead is here shown in graphic form. Squares represent males and circles females; black symbols designate individuals who show the trait in question; x implies unknown; the abbreviation *d.inf.* means "died in infancy." Some doubt exists as to whether individual No. 7 in generation II showed the trait or not. (Fig. 7.)

HEREDITY OF WHITE FORE-LOCK

Blaze in the Hair Transmitted Through Many Generations—Appears to Behave as Simple Dominant and to Follow Mendelian Proportions—History of an American Case.

NEWTON MILLER

Professor of Biology, Wheaton College, Norton, Mass.

ALBINISM in man has been frequently recorded during the last two centuries, but it is only comparatively recent that data have been collected with the object of explaining its behavior in inheritance. A glance at the excellent monograph by Pearson, Nettleship and Usher shows that albinism may appear in almost any degree from a mere colorless spot to a complete lack of pigment in hair, skin and eyes. The former is the condition with which we are at present concerned.

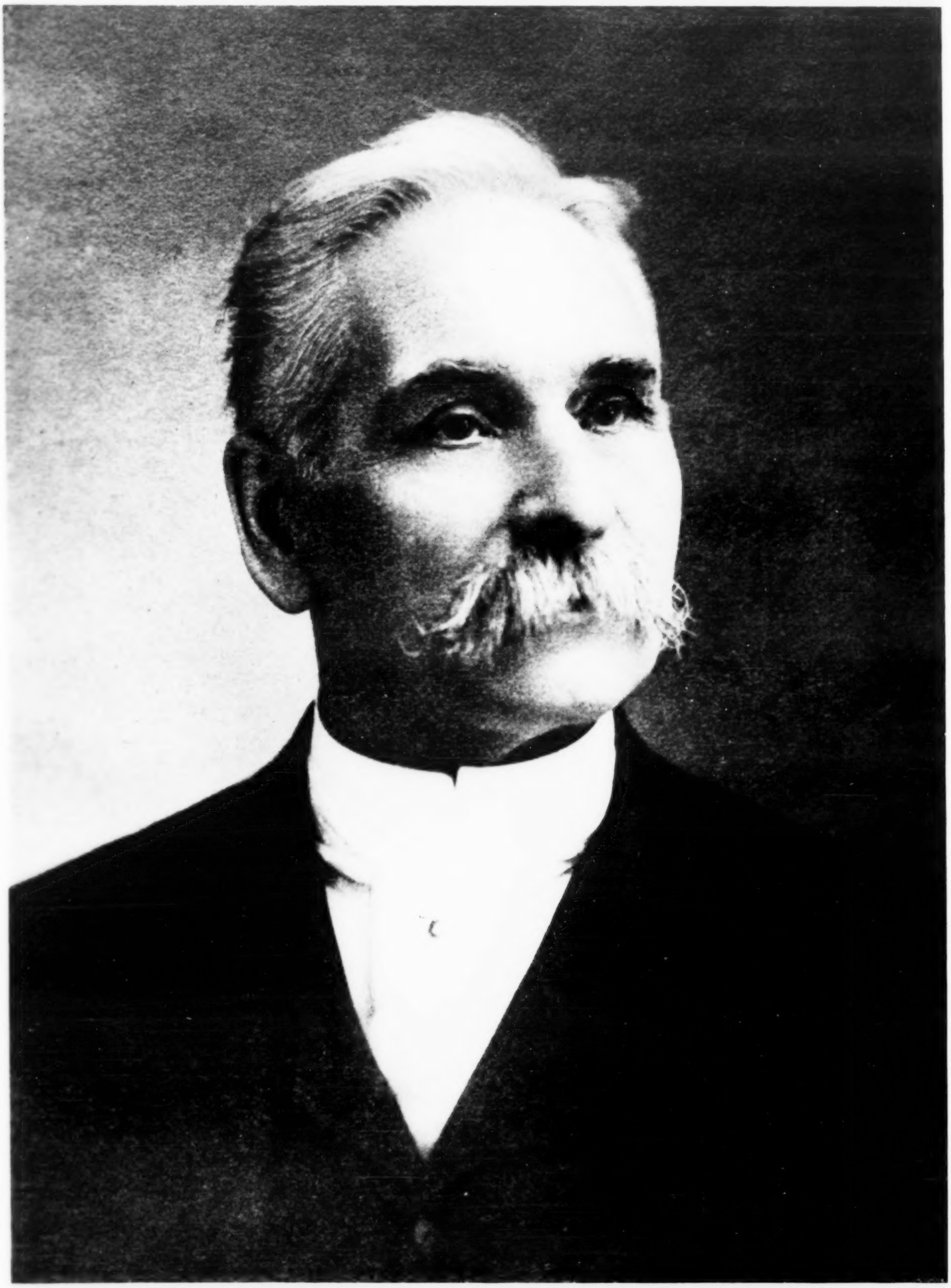
Rizzoli published in 1877 a record showing a fore-lock of white hair running through six generations of a family comprising 49 individuals in the direct line of descent. A similar account by Harman appeared in 1909. In Harman's case the "flare" cropped out in six successive generations of a family numbering 138 members in the direct line. Other colorless patches are said to be found on various parts of the body in this family. Three years later Cane referred to a family of 42 individuals with a white frontal lock appearing in each of the four generations mentioned. The pedigree which I offer is in many respects a duplicate of those cited above.

I am indebted to Miss Agnes Joynes (IV. 38), a member of the family, for the active part she has taken in the collection of the data for this study and to her is due the greater credit for the record.

In the year 1821 a Mr. Little with his three daughters immigrated to America from Carlisle, England, and settled on a branch of the St. John river in New Brunswick, Canada. His only son, Dr. William Bell Little (II. 3), followed two or three years later and made his home also in New Brunswick. It is in the descendents of Dr. Little that the white lock may be found in the American branch. The family traces its origin back through the Percys, Mortimers, even to Edward III. We are interested in the family of Harry "Hot-Spur" Percy for here, according to a current story, originated the white lock. Harry "Hot-Spur" in a rebellion against Henry IV. was killed in the battle of Shrewsbury, 1403. When the news of his death reached his pregnant wife, she swooned, pressing her hands to her forehead as she did so. The son born a few hours later bore a white patch on his forehead corresponding to the spot touched by Lady Percy as she swooned. The mark has since appeared in some members of each and every generation of this child's descendants. Dr. Spurgeon Jenkins (IV. 4) has suggested the direction in which explanation should rather be sought. While in England he looked up his antecedents and found to his satisfaction that the colorless patch goes back to the Percys, but he found also that Lady Percy was an albino. This of course is no explanation, since there is no record of an albino giving rise to spotted individuals or spotted to albinos.

LOCATION OF THE LOCK.

The white lock located on a white patch of skin on or near the median line of the forehead and crown in the American family stands out prominently in contrast to the black or brown hair adjoining. In addition, other colorless spots are to be found on the bodies of some of the individuals possessing the "flare." The mother of V. 18 describes her son thus—"a white heart-shaped spot on the forehead just

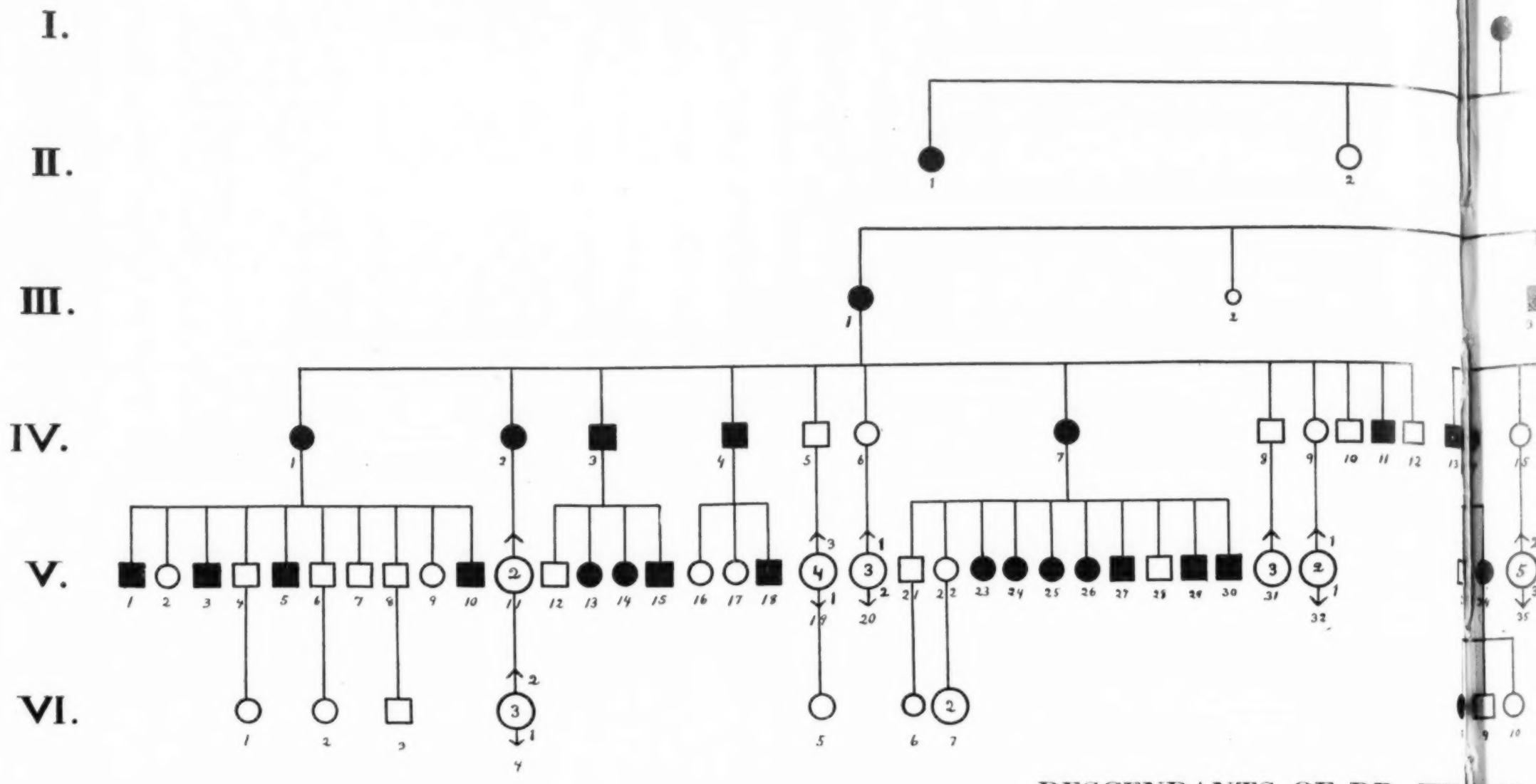


AN EARLY POSSESSOR OF THE LOCK

This man is designated in the pedigree chart (Fig. 10) as III, 10, and is therefore a son of the Dr. Little who brought the trait to America. He passed it on to his son, with whom this line stopped. In the family, however, it is definitely charted for six generations, and at least two other families have been studied where the trait has been traced for six generations, while in many cases a similar lock has been followed through several generations until lack of data forced the investigator to abandon his quest. (Fig. 8.)

THE WHITE LOCK, SPREAD OUT

This girl, V. 14 in the pedigree chart (Fig. 10), is a sister of the girl shown in the frontispiece. There were two brothers and two sisters in this family; both sisters and one brother had the white lock which, on the average, has characterized half the stock in which it is running. (Fig. 9.)



DESCENDANTS OF DR. WILLIAM

Dr. Little, a resident of Carlisle, England, and a descendant of the famous Percy family, emigrated to Amer abou hair, and has passed this on to a large number of his descendants. The above pedigree chart shows 20 meml that the individual was marked by the white lock of hair. For the sake of conciseness, large symbols nclosi indicates the number of children in the fraternity, a smaller numeral above showing the number who we boys matings has not been shown, since they were all with unaffected individuals. Thus when a parent has black one not possessing it (recessive), or in genetic notation a DR mating, while when the symbol is white mean between two who did not carry the trait; in such cases, the trait could never reappear in their descendant (Fig

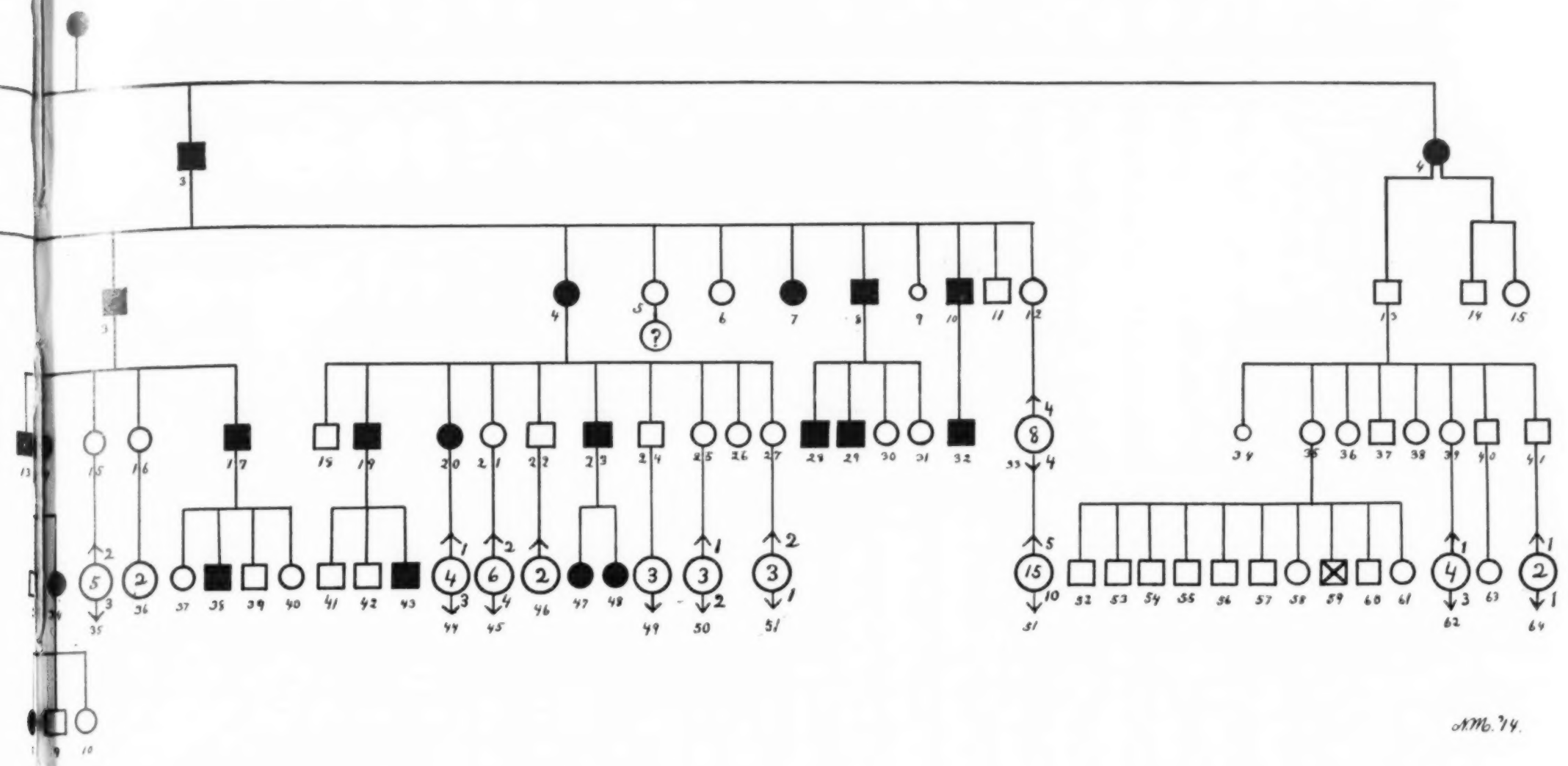
below the white lock of hair, a white heart-shaped spot on the right knee with a ribbon running down the leg and encircling the ankle, and a white mark on the abdomen."

Lad (V. 59) now 12 years of age had in his early childhood a patch of yellowish hair on the back part of his head. At this time, however, its color has changed completely to that of the rest of his hair.

The accompanying chart represents 203 individuals of whom we have accurate information. All are blood related. Only one consanguineous marriage has been contracted, that of a son of III. 5 and the third daughter of III. 12. Both families of III. 5 and III. 12 are free of the mark and the four children of the cousin marriage are also.

An examination of the chart shows that the white lock crops out only in those families one parent of which is thus marked. It is further seen that the lock behaves as a simple dominant with normality as recessive. Consequently two types of matings are represented, *i. e.*, DR x RR and RR x RR, the individuals with the frontal patch being hybrids (DR) and the others (RR) pure recessives. Theoretically we should expect to find the leucotic spot in one-half of the children in families where one parent is marked, and not at all in children of unmarked parents. These expectations are fairly well borne out by the actual data which give for the former 45 with, to 51 without the "flare," and for the latter, none.

The above statements apply equally well to the cases of Rizzoli, Harman and Cane. These pedigrees give the proportions of those with, to those without the albinic lock as 17 to 15, 23 to 15 and 23 to 13, respectively. Combining the data at hand we obtain the interesting result of 108 with the white lock and 94 without. Thus the conclusion seems warranted that the white lock is a simple dominant and that it follows closely the Mendelian law.



AM. '14.

VIL AM BELL LITTLE (II. 3)

ner about 1824 and settled in New Brunswick. He had inherited from his mother a congenital white lock of s 20 members of the family, squares representing men and circles women. When the symbol is black, it indicates bol nclosing a number have been used to designate several fraternities of unaffected individuals; the number we boys and a similar numeral below those who were girls. Further for the sake of brevity, the exact nature of the has black symbol, it is to be understood that the mating was between a person possessing the lock (dominant) and ite means that an unaffected, or recessive, person married a similar person, the mating (RR) therefore being ant (Fig. 10.)

REFERENCES

CANE, M. H. 1912. Hair and its Heredity.—Eugenics Review, Vol. IV.

HARMAN, N. B. 1909. A Study in Heredity —Six Generations of Piebalds. Trans. Ophthal. Soc., XXIX.

PEARSON, NETTLESHIP AND USHER. 1911 and 1913. A Monograph on Albinism in Man. Draper's Co. Research Memoirs, Biometric Series IX.

RIZZOLI. 1877. Title? Bulletino delle Scienze mediche Bologna. Ser. V., Vol. 23.

Rizzoli's pedigree as taken from a MS. copy is published in the above monograph by Pearson, Nettleship and Usher.

Breeding Hardy Winter Barley

Until now, winter barley has not been a success north of the Ohio river, as all previously existing varieties were killed by hard winters. The Michigan Experiment Station has three winter barleys that successfully passed the severe winter of 1911–12 and one of these is being increased at the Upper Peninsula Station at Chatham. It has done well there, and this fact seems to indicate that these varieties may extend the winter barley belt to Lake Superior.

The two winter barleys that were increased at East Lansing in 1914 were ripe on June 24, or three weeks earlier than the earliest spring barley. During the seasons of 1913–14, these two strains have averaged 55.4 bushels. The average production of barley in Michigan is set at 25 bushels by the U. S. Department of Agriculture. If generally grown, these winter barleys may double the average yield of barley in the state. Compared with oats on the basis of pounds of grain per acre, 55.4 bushels of barley equals 83.1 bushels of oats.

EUGENICS AND IMMIGRATION

Large Amount of Bad Breeding Prevented by Medical Examination of Aliens at Ports of Entry—Detection of Defectives More Thorough Now Than Ever Before, Because of Decrease in Numbers Arriving.[1]

DR. L. E. COFER
Assistant Surgeon General, U. S. Public Health Service, Washington, D. C.

THE word "Eugenics" has appeared in literature only within the last ten years. It may be defined in a few words as a science which attempts to improve the physical development and mental equipment of the individual in so far as this may be possible by heredity. The attempt to improve human stocks of all kinds during recent years has taken form, so far as it relates to immigration, in preventing unfit persons from coming into the country, either by being born into it or by being brought into it by migration.

In the same sense the execution, incarceration or asexualization of criminals, or the segregation of certain other classes—paupers, insane persons, idiots, lepers and the like—tend to raise the quality of the human stock.

Properly speaking, however, eugenics does not include so much the prevention of the production of unfit, as it does the attempt to produce the more fit. On stock farms all over our country, in private stables and in kennels men are spending their lives in the improvement of our breeds of horses, cattle, sheep, dogs and swine. By selective breeding it is quite possible to breed cows which will yield about 12 gallons of milk per day, which means that a 1400 pound cow will yield her own weight every two weeks. We exercise similar care and thought in the development of our grains, vegetables and fruits. Every effort is being made to produce and perpetuate those forms which come the nearest to meeting our ideal. It is therefore probably a just charge that we are more careful of the breed of our horses and dogs than of our children. A natural question would be, then, why is it that with all our efforts to improve the breed of domestic animals, we have neglected the breed of the most important of them all, that is, the human animal? Why have we left the breed of men altogether to chance? We are beginning to ask ourselves these questions, and we are beginning slowly to realize that if society had done its full eugenic duty many a long line of defectives and criminal descendants of defectives would never have been born. It is claimed by many people that we are doing everything we can to encourage the production of defectives, degenerate and delinquent persons by the way in which we feed and clothe them, by the way in which we increase the annual sums for asylums, almshouses, prisons, hospitals, etc., in which we can confine our insane, paupers, habitual criminals, and imbeciles, leaving them free, during a part of their lives, in any event, to propagate their kind, and it has been shown that this class of persons, if given opportunity, is relatively more prolific than the better and more useful class of citizens.

THE IDEAL OF EUGENICS.

And thus we come to ask why we can not breed the superman, or in other words we are discussing the artificial breeding of mankind itself. Unfortunately the average advocate of eugenics as applied to man is apt to consider the production of superman bodies paramount to the production of superman

[1] Address delivered before the Young Men's Christian Association of Washington, D. C., February 18, 1915.

minds, superman character, or persons with superman souls. That is to say, the superman who will be assembled for the purpose of leading a strenuous life to improve the world is the one whom many of us have in mind especially if we read Bernard Shaw.

Really the production of an evenly balanced, conservative, intelligent and healthy individual should be the aim of eugenics, and not the raising up of a monstrosity or curiosity in human life.

In the eighteenth and nineteenth centuries, Europe attempted to improve its race stocks by the deportation of the less desirable individuals. Each country had its penal colonies, and in addition used the United States as a dumping ground for its convicts, paupers and insane. The immigration laws of the United States, which purport to exclude some twenty-one classes of mentally, physically, morally and economically undesirable persons, were originally intended to protect the country from the dumping process above described. But, inasmuch as they operate equally in the cases of assisted and of normal immigration, they really go further than this; and, so far as they are enforced, tend to eugenic results by selecting the better classes of aliens for the fathers and mothers of future citizens.

This brings us to the consideration of immigration in its general sense. The migration of men or other animals is caused almost entirely by the universal search for food. Man, like every other organism, spreads all over the earth in search of a living, and when he finds himself in a locality able to support him, he is usually willing to remain there. It will usually be found, therefore, that the average immigrant's reason for shifting his residence from some other country to this country is the relative over-population of his native country. The term "over-population" is given to a place which contains more people than can be fed with food raised in that country. The word "over-population," however, has been discarded and the word "saturation" has replaced it, for the reason that it is easier to think of the migrations of the peoples of the world as fluid-like migrations, on the general principle that water always seeks its level, and that a sponge more than saturated will begin to drip. Therefore, a locality overcrowded with inhabitants is not unlike a soil which cannot possibly hold all the rain which is poured on to it. Some must run off or be evaporated after collecting in pools. The overpopulated or saturated place is one which cannot hold the rain of babies poured upon it. They too collect in pools of humanity to be evaporated in pools of death, or they must flow off in streams in one direction or another, and these streams are the streams of migration, which when they converge at the shores of our country are termed by us our streams of immigration.

THE STREAM OF IMMIGRANTS.

Now let us see what these streams of immigration mean to the United States. During the fiscal year ended June 30, 1914, 1,485,957 immigrants landed on our shores; the year before that 1,574,-371 landed; the year before that 1,143,-234 landed; the total for the last six years being 7,544,452. In other words, considerably more than 1,000,000 persons a year from other countries have migrated to our shores during the last six years. These immigrants comprised Africans, Armenians, Bohemians, Moravians, Bulgarians, Servians, Montenegrins, Chinese, Croatians, Slavonians, Cubans, Dalmatians, Bosnians, Dutch, Flemish, East Indians, English, Finnish, French, Germans, Greeks, Hebrews, Northern and Southern Italians, Japanese, Lithuanians, Magyars, Mexicans, Poles, Portugese, Roumanians, Russians, Ruthenians, Scandinavians (who comprise Norwegians, Danes and Swedes), Scotch, Slovaks, Spanish, Spanish Americans, Syrians, Turks, and West Indians.

These immigrants enter the United States through 88 different places, which places include 25 different ports, and they embark for the United States from 25 different foreign ports. Exclusive of the number of railway lines continuously bringing immigrants over our borders, over 100 steamship companies were occupied, prior to the

beginning of the European war, in the immigrant-carrying trade, and on account of the fact that certain steamship lines had vessels arriving at from two to five different ports, it was found that there were about 173 lines of immigrant travel into this country.

It must not be supposed that these million or more immigrants are allowed to enter the country just as any of us might go from here to New York. On the contrary they are subjected to a series of examinations tending to the elimination, in the first place, of paupers and criminals, and secondly, to the elimination of persons with physical and mental defects. At every port or place in the United States where immigrants arrive, the United States Immigration Service, under the Department of Labor, has officers stationed for the examination of immigrants, to insure compliance with the immigration law, exclusive of matters relating to the physical and mental condition of aliens, which is in charge of the U. S. Public Health Service, under the Treasury Department. This latter Service has medical officers at all the ports of entry, who subject the immigrants to a careful medical examination.

DEFECTS EXCLUDED.

The number of immigrants examined by these medical officers varies from one a year at the port of Aguadilla, P. R., to 1,009,000 at the port of New York. The following classes of aliens are excluded from admission into the United States: Idiots, imbeciles, feeble-minded persons, epileptics, insane persons, persons who have been insane within five years previous; persons who have had two or more attacks of insanity at any time previously; paupers, persons likely to become a public charge; professional beggars, persons afflicted with tuberculosis or with a loathsome or dangerous contagious disease; persons not comprehended within any of the foregoing excluded classes who are found to be and are certified by the examining surgeon as being mentally or physically defective, such mental or physical defect being of a nature which may affect the ability of such alien to earn a living.

In order that the provisions of this law may be put into convenient form for the use and guidance of the medical examiners of aliens, the Public Health Service has issued a book entitled "Book of Instructions for the Medical Inspection of Aliens." In this book the diseases are placed under four headings as follows: Class A-1, Class A-2, Class B and Class C. Under Class A-1 are included idiocy, imbecility, feeble-mindedness, epilepsy, insanity and tuberculosis. Under Class A-2, which is devoted to loathsome, contagious or dangerously contagious diseases, are included favus, ringworm of scalp, sycosis barbae, actinomycosis, blastomycosis, frambesia, mycetoma, leprosy and venereal diseases, such as demonstrable syphilis in an active, communicable stage, gonorrhea and soft chancre. Dangerous contagious diseases include trachoma, filariasis, uncinariasis (hookworm), amebic infection and endemic hematuria. Under class B are included those defects or diseases which affect the ability on the part of the immigrant to earn a living. From the very nature of the diseases included under this subdivision it is apparent that it is impossible to name all of them, but a few are as follows: hernia, the various varieties of heart disease, states of permanently defective nutrition and of marked defective skeletal and muscular development, cases of chronic arthritis and myositis, the various nervous affections, malignant new growths, deformities, varicose veins, senility, defective eyesight, various cutaneous affections, anemia, eruptive fevers, and such tuberculous affections as lupus, Potts disease, hipjoint disease, chronic inflammation of the lymph glands, chronic arthritis of knee joint; in fact, all those diseases of a more or less permanent character which call for institutional care and treatment are included under Class B. Under this heading are given cases of diseased, deformed or crippled children who will require unusual care during childhood, and who are likely to be physically defective if they live to reach maturity. Under Class C come defective or

diseased conditions which do not present in the opinion of the medical examiner requirements for certification under Classes A and B. In other words, Class C is intended to make a complete check as to the physical status of an immigrant. For instance, if an immigrant is found to be perfectly sound with the exception of the absence of two fingers on his left hand, the condition would be considered a reportable one, but not a deportable one.

WORK IS ONEROUS.

Now a word as to what it means to examine physically the aliens entering the United States from foreign countries: During the fiscal year just passed 94 officers of the Public Health Service have been assigned exclusively to the work of examining arriving aliens, and in addition to this a number of officers, although detailed to other duty, have given more or less of their time to the work under consideration.

The results of this examination, which constitutes the practice of eugenics in connection with immigration, are as follows: In the fiscal year just passed, of the 1,485,957 aliens arriving, a total of 41,250 were certified for all causes, of which 3,051 were for trachoma alone; 184 for tuberculosis; 1,040 for syphilis; 157 for gonorrhea and 1,360 for mental deficiency of various kinds. During the last six years, of the 7,544,452 immigrants arriving, a total of 179,557 have been certified, of which 15,971 were certified for trachoma (a dangerous, contagious eye disease); 1,408 for tuberculosis; 1,537 for syphilis; 924 for gonorrhea, and 3,788 for mental deficiency of various kinds.

It is evident that eugenics along the lines above mentioned does not attempt directly to produce the more fit, but it does actually prevent the entry of an enormous percentage of the unfit, as will be seen by the following statistics. The reports of immigrants arriving during the fiscal year ending June 30, 1914, show that of the total number, 1,485,957, there were 313,475 women between the ages of 14 and 44, and that there were 668,217 males between these ages. Statistics also show that the percentage of childless women among immigrants is never higher than 20% in some nationalities, and is as low as 2.5% in other nationalities; also that the child-bearing immigrant women bear from 2.4 to 5.5 children, the average being about 4 children for each child-bearing woman. It is furthermore a general rule that women in the rural communities bear more children than the women in the cities. If from the total number of women arriving in the last fiscal year 20% is deducted as non-child-bearing (which, while by no means fair and accurate for the purpose under consideration, will all the more show the value of our eugenic work) 250,780 women will be left who, according to statistics, will bear an average of four children each, making a total of about 1,000,000 children destined to be born from the immigrant women arriving last year.

It will be seen that by the rejection alone of the 1,360 mental defectives last year an enormous amount of good has been done in preventing births amongst this class of persons. The same may be said in regard to the prevention of propagation amongst the immigrants rejected for the other diseases mentioned, most of which have a distinct tendency towards producing inferiority in offspring. It is manifestly impossible to determine the good results of this examination, and therefore its eugenic value to the country, but there are some facts which will show that the medical examination of immigrants and the rejection of the physical and mental defectives is producing invaluable results. For example, no satisfactory evidence has yet been produced to show that immigration has resulted in an increase in crime disproportionate to the increase in adult population. Such comparable statistics of crime and population as it has been possible to obtain indicate that immigrants are less prone to commit crime than are native Americans, a fact which is a distinct tribute to the good work being done by the immigration officers along the line of preventing to a great extent the landing of immigrants from the criminal classes.

In this connection, however, it is interesting to note that statistics indicate that the American born children of immigrants exceed the children of natives in relative amount of crime. It also appears from data bearing on the volume of crime that juvenile delinquency is more common among immigrants than it is among Americans. There are, however, two factors affecting these conclusions. First, immigrants are found in greater proportion in cities than in rural communities, and the criminality of the children of immigrants is largely a product of the city. Second, the majority of the juvenile delinquents are found in the North Atlantic states, where immigrants form a larger proportion of the population than in any other section of the country.

EFFECTS OF THE WAR.

Just what the eugenic result of the medical examination of aliens has been during the last five years is not known for the reason that census statistics along these lines are lacking. The European war, however, has divided the observation periods, so far as the results of the medical examination of aliens is concerned, into three parts, the first part ending with the commencement of the European war, and with the almost shutting down of immigration from Europe. The second period we are passing through at the present time; that is, the period of duration of the war. The third period will begin with the ending of the war and the resumption of immigration, which it is predicted will be greater than we have ever before experienced.

As a consequence of the war many undesirable persons are not being admitted to our country. If the war continues for a long time we may expect a gradual decrease in our institutional mental and physical defectives, now being cared for at the expense of states and municipalities, but what will be the result when the war ends? Shall we have an influx of physically and mentally deteriorated men, drawn from among the survivors of the great conflict, and from the non-combatants who are suffering as much from privation as the soldiers are from shot, shell and disease; and what will be the permanent character of the defects which these immigrants will present? Will there be more insanity amongst them, or will they present a larger proportion of syphilitic infection, or both? During the second period, or war period, that is to say, the period through which we are now passing, almost the same number of medical officers of the Public Health Service are engaged in examining aliens as were engaged prior to the commencement of the war, although the number of immigrants arriving is very much diminished at all stations, and in certain places, for example, New York and the large ports generally, the volume of immigration has diminished to one-fourth or one-fifth, so that the quality of the medical examination being given at the present time is much ahead of what it has ever been before. As a consequence statistics at the end of this fiscal year will show a large increase in the percentage of rejections from all causes. If the war lasts a considerable length of time, it will be possible to obtain sufficient data as to the results of the preventive eugenic work which has been accomplished to enable us to make intelligent preparations for meeting the increased demands to be made upon the country when immigration from Europe is again resumed.

Breeding Sugar Beets

The Utah state agricultural experiment station has been breeding sugar beets for increased sugar content for many years. After the first seven years of the experiment, all of the large number of strains tried were discarded except one, the progeny of which is now widely grown. "The manager of our local company," Director E. D. Ball writes, "has just recently made the statement that he could tell to the row in the field where our local seed was used, by the uniform character of the beets, and that the average sugar content was from one to two per cent. higher than that of the best European seed obtainable."

FANCY POINTS vs. UTILITY

Many Animals and Plants Scored for Characters That Are Useless or Even Detrimental to Production—Egg Yield of Fowls Neglected—Need For Revision of Standards.

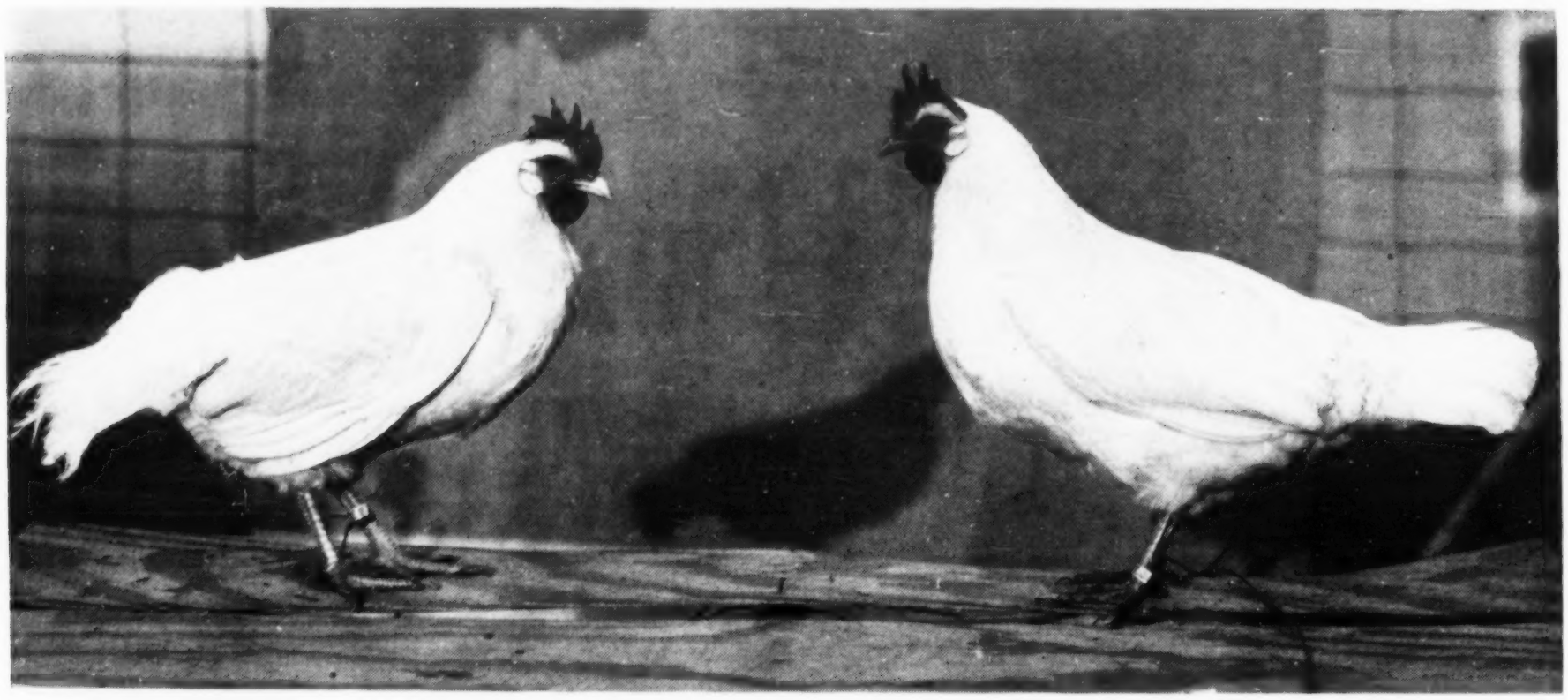
A. F. Blakeslee
Professor of Genetics, Connecticut Agricultural College, Storrs, Conn.

IT seems not out of place in a magazine devoted to breeding and to the development of characters which are judged in the show room, to say a few words in regard to the points and the standards recognized by the show room judge.

Plants and animals have been domesticated and cultivated for one or both of two main reasons—for the pleasure which their presence gives us or for some useful product which they yield in the form chiefly of food, clothing or labor. The distinction is not absolute, even as the distinction between beauty and utility cannot be absolute, but in general we may distinguish the forms primarily ornamental from those primarily useful. The first are grown as pets, the second for utility. The geranium, the cat, the canary bird and the bantam fowl are pets; the cow, the horse, the laying hen and corn are cultivated for utility. The tomato in our grandmother's garden was cultivated for its ornamental fruit and was a pet. Now it has been moved to the vegetable garden and is grown for utility. Ornamental things may be useful, and the market value of a product is not diminished by the inherent beauty of the producer. As the lowing herd winds slowly o'er the lea, it offers no less interesting a sight to the poet and to the artist if the animals are high milk producers. That they are the best of their kind should in fact heighten his admiration. On the other hand, the perfection of form and color that appeals to the eye may indirectly affect the yield. The pride of the flock or of the field will be most tenderly cared for.

A visible character that has a direct connection with yield may be called a utility point while one that has no such direct connection is called a fancy point. Each may be developed without injury to the other, but the man who aims at but a single target is most likely to reach his mark. Seek ye first the most valuable thing and let other good things be as additions unto you, is good advice for all manner of men. To the practical breeder the most valuable thing is yield. This the show room almost entirely leaves out of consideration either directly or by scoring on a multitude of fancy points that often have at best only a fancied connection with the object for which the breed is supposed to be cultivated. In the score card for dairy cattle no place is left for the quantity or quality of milk which the animal is capable of giving. In the ear of corn attention may be given to the straightness of the rows and the completeness with which the tip of the ear is filled out, but the yield per acre is not recorded. The score card for poultry, of which two are shown in Figure 13, gives ten points each for comb, wings and tail, but no credit is given for the number of eggs a bird has laid. Men have paid high prices for prize-winning hens that have failed to produce eggs after they were taken from the show room.

Attempts in many cases have been made to use characters in the score card that may be indicative of yield. In corn, the filling out of the tip, the size of the ear, the size and compactness of the kernels, are all characters that influence the amount of food substance carried by any individual ear but are not of necessity correlated with the yield per acre. In the experience of the



GOOD AND BAD EGG-PRODUCERS

A pair of White Leghorns in the egg-laying competition at Storrs, Conn. The hen at the left (No. 722) is the best layer among the 400 White Leghorns competing. Up to February 23, she had laid 70 eggs. The hen at the right (No. 723) is from the same pen, but laid only nine eggs during the same period. The good layer has pale beak, pale legs and white ear-lobes, while the poor layer shows yellow in these parts. The Standard of Perfection demands yellow in beak and legs, and the poor layer was scored the higher by the professional poultry judge. But there is reason to believe that an absence of yellow in these parts denotes high egg-capacity and its presence low fecundity; if this is the case, then the Standard and the judges are working directly against high production which, after all, is the purpose of a fowl. Photograph made February 22, 1915. (Fig. 11.)

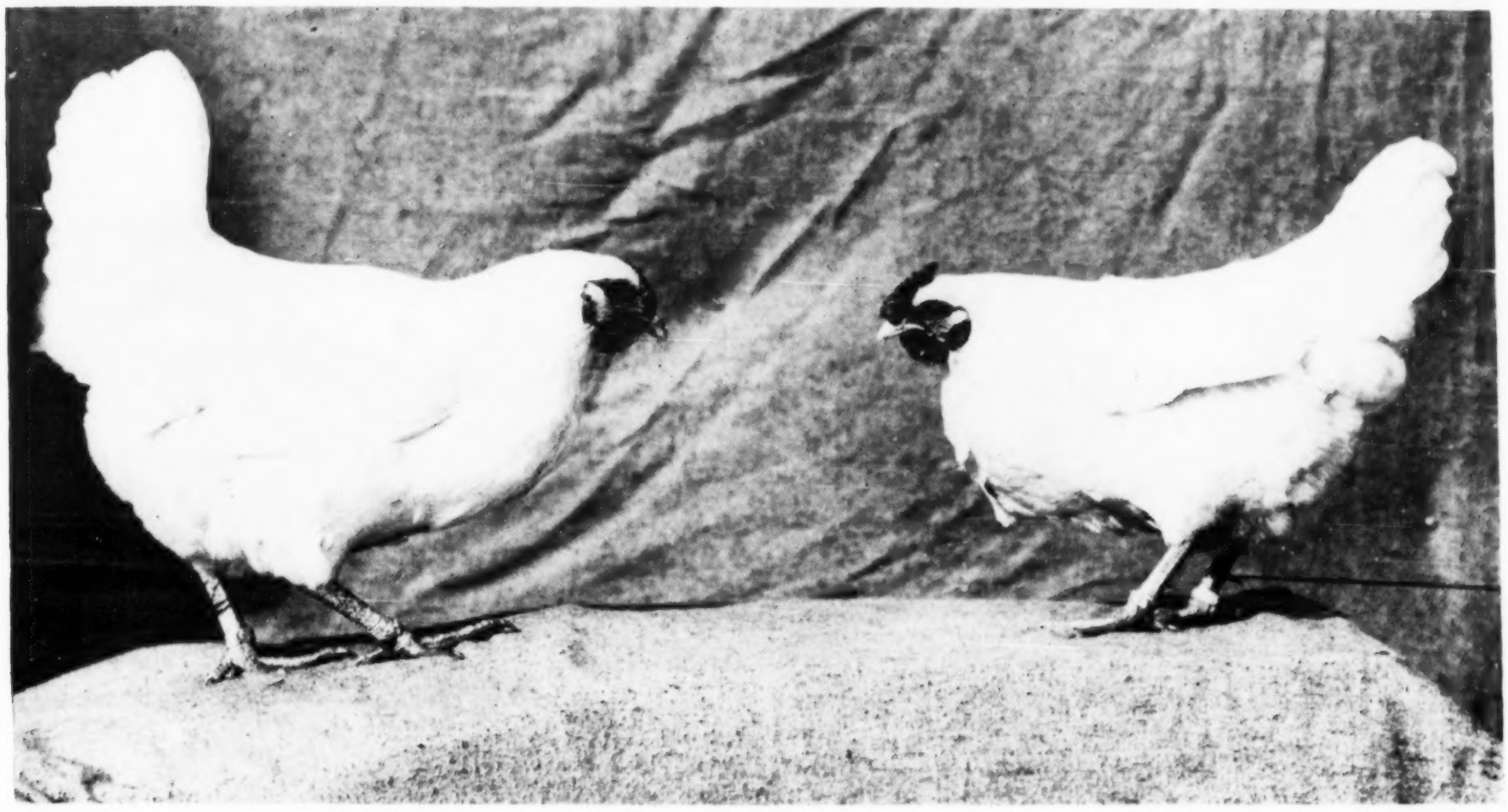
Connecticut Experiment Station, poor scoring strains of corn have been found to out-yield better scoring strains in comparative test cultures.

In dairy cattle, the size and character of the milk veins are apparently considered strongly indicative of the quantity of milk an individual cow can produce. In Jerseys, four points are allowed for milk veins in the score card; in Ayrshires, five; in Guernseys, eight; and in Holsteins, ten. There is no evidence that the value of the milk veins as an index of the flow of milk differs in the breeds mentioned in any direct relation to the actual number of points allowed in the various score cards.

POULTRY STANDARDS.

In poultry probably less attempt is made to use characters in the score card indicative of yield than in most other economic breeds of animals or of plants, and the standards may be so fictitious that they are even directly opposed to the natural development of the animal. As an instance of the latter condition may be mentioned the barring in Plymouth Rocks. Dark and light strains exist in this breed, but in a given strain the males are naturally lighter than the females. Barring is a sex-linked character, and this lighter color of the male is probably due to his having the factors that lighten up the plumage present in a duplex condition. At any rate, the lighter color of the barred male is as natural a condition in the breed mentioned as is the presence of a beard in the male of the human species. In order to win prizes for exhibition pens, however, poultrymen have resorted to so-called double-mating, breeding males from dark strains and females from light strains, since judges give preference to pens in which the males and females are matched in shading. The practice is as logical as to require a man and his wife to match in the amount of hair on the face. In the human species, however, we are assured that we shall be judged for our good deeds and need stand in no fear of fancy points in the score card at the last day of judgment.

Most fancy points probably are indifferent so far as they directly in-



SHOW POINTS OPPOSE PRODUCTION

A pair of White Wyandottes in the Storrs contest. At date of photographing (Dec. 23), the hen at the left (No. 137) had laid no eggs, while the one at the right (No. 132) had laid 34 and was the best layer in the pen. The function of a hen is to lay eggs, and to produce egg-layers should be the object of the breeder. The standards should, therefore, be set up with this object in mind. Yet the poor layer here shown was scored higher than the good layer, 92½ points as compared with 89¼, the good layer being cut, among other reasons, because her beak was faded. The score cards are shown in the following figure. The left-hand bird, which when photographed had yellow beak and yellow legs, had produced only 13 eggs up to February 23, while the bird that shows pale beak and legs had a record of 81 during the same period. (Fig. 12.)

fluence the practice of breeding plants and animals for utility. The danger is that they tend to substitute a fictitious standard for real value and thereby distract the aim of the breeder. In some cases, however, the standards may be in direct opposition to utility. It seems not inappropriate to discuss as an example, a fancy point directly opposed to utility that has come to the writer's attention in connection with an investigation undertaken with D. E. Warner. A preliminary report on the work is presented in *Science*, Mar. 19. It has been found that the yellow pigment in the ear-lobes, the beak and the legs of Leghorn pullets disappears when they begin to lay and returns again when they cease laying. The ear-lobe is apparently most quickly responsive, the beak next and the legs are the last to be affected by a change in the laying activity. Figure 11 is a photograph of two Leghorns which showed a difference in color in the parts mentioned. The good layer had 15 per cent. yellow in her ear-lobes while the poor layer showed 35 per cent. yellow in the same parts. The color of the ear-lobes has been measured by means of a color top, and a high negative correlation established between laying activity and the amount of yellow pigment present. The tables for this are published elsewhere.

The beaks and legs have been roughly graded as pale, medium and yellow. In Table I is shown the percentage of the birds in the different color groups actually found laying on the last of October. If a bird was laying on the day of record she is credited with a zero, if on the day before the record was taken, she is credited with one "day since laying." The yellower the ear-lobes, the beak and the legs, the longer on the average since the last egg was laid. The Wyandottes are a type of fowl that do not show color changes in their ear-lobes, which remain permanently red.

The beak and legs alone in such breeds, however, form a ready means of selecting the laying hen.

PRODUCTION PENALIZED.

The "Standard of Perfection" which controls the judges in the show room demands yellow in the beak and legs of the two types of breeds recorded in Table I. Other things being equal therefore, in preferring the bird with yellow beak and yellow legs, the poultry judge is preferring the poorer layers. That this is not a mere theoretical conclusion is illustrated by Figure 12. The best layer in the pen was scored down because her beak appeared faded. In other fancy points also she was a poor scorer—in fact had the lowest score in her pen. Her score card is shown in Figure 13 alongside that of the highest scoring bird from the same pen. The highest scorer, however, turned out to be the poorest layer in the pen. Their egg records up to Feburary 23rd are shown in Figure 14.

The blanks in Figure 14 show a type of score card that is well nigh ideal. Perfection is judged by production. A bird, or a pen, that wins in such an egg laying contest as the one conducted at Storrs, Conn., is obliged to lay eggs.

TABLE I.

Percentage of Birds Laying, Average Number of Days since Laying and Yearly Totals for Different Color Grades of Beaks and Legs.

(P, M and Y are abbreviations for Pale, Medium and Yellow; the color of beak is written first followed by color of legs.)

WHITE LEGHORNS (256 Birds with yearly average of 150.4 eggs).

	P.P.	M.M.	Y.Y.	P.M.	P.Y.	M.P.	M.Y.	Y.P.	Y.M.
Number of Birds	51	17	97	2	0	25	1	14	49
Average days since laying	6.6	30.4	57.8	30.5	.....	20.8	64.0	28.6	45.9
Number Birds laying	32	2	1	0	.....	3	0	1	1
Percentage Birds laying	62.8	11.8	1.0	0.0	.....	12.0	0.0	7.2	2.0
Yearly averages	186.4	146.4	129.3	150.5	.....	178.7	122.0	158.4	139.9

WYANDOTTES (79 Birds with yearly average of 144.8 eggs).

	P.P.	M.M.	Y.Y.	P.M.	P.Y.	M.P.	M.Y.	Y.P.	Y.M.
Number of Birds	28	13	24	1	0	4	0	0	9
Average days since laying	6.5	17.5	48.9	0	.....	7	.....	.....	28.7
Number Birds laying	16	5	0	1	.....	2	.....	.....	1
Percentage Birds laying	57.2	38.5	0.0	100.0	.....	50.0	.....	.....	11.1
Yearly averages	178.3	130.7	108.4	194.0	.....	161.5	.....	.....	145.6

TABLE II.

Yearly Egg Records for Hens Pale (P) in Different Parts. (256 White Leghorns with yearly average of 150.4 eggs.)

Number of Birds	Ear-lobes	Beak	Legs	Yearly Average
90	.....	.....	Pale	179.9
53	.....	Pale	.....	185.3
40	10–20% yellow	.....	.....	189.4
51	.....	Pale	Pale	186.4
31	10–20% yellow	Pale	Pale	191.9

EACH SECTION COUNTS 10 POINTS.		
	CONDITION WEIGHT OR SIZE	
	COMB OR CREST AND COMB	1 1/4
	HEAD AND ADJUNCTS — Beak	1/4
	HEAD AND ADJUNCTS — Eyes	1/2
	HEAD AND ADJUNCTS — E. Lobes	
	HEAD AND ADJUNCTS — Wattles	
	NECK — Shape	1
	NECK — Color	1/2
	BACK — Shape	1 1/2
	BACK — Color	1/2
	BREAST — Shape	1
	BREAST — Color	1/2
	BODY AND FLUFF — Shape	1/2
	BODY AND FLUFF — Color	1/2
	WINGS — Shape	X
	WINGS — Color	1/2
	TAIL — Shape	1 3/4
	TAIL — Color	1/2
	LEGS AND TOES — Shape	
	LEGS AND TOES — Plumage	
	LEGS AND TOES — Color	
	TOTAL DEFECTS	10 3/4

EACH SECTION COUNTS 10 POINTS.		
	CONDITION WEIGHT OR SIZE	X
	COMB OR CREST AND COMB	1 1/4
	HEAD AND ADJUNCTS — Beak	
	HEAD AND ADJUNCTS — Eyes	X
	HEAD AND ADJUNCTS — E. Lobes	
	HEAD AND ADJUNCTS — Wattles	
	NECK — Shape	3/4
	NECK — Color	1/2
	BACK — Shape	X
	BACK — Color	1/2
	BREAST — Shape	3/4
	BREAST — Color	1/2
	BODY AND FLUFF — Shape	1/4
	BODY AND FLUFF — Color	1/2
	WINGS — Shape	X
	WINGS — Color	1/2
	TAIL — Shape	1 1/2
	TAIL — Color	1/2
	LEGS AND TOES — Shape	
	LEGS AND TOES — Plumage	
	LEGS AND TOES — Color	
	TOTAL DEFECTS	7 1/2

ORDINARY TYPE OF POULTRY SCORE CARDS

Essential parts of the score cards of the two White Wyandotte hens shown in Fig. 12. At the left is the list of "cuts" made by the professional judge against No. 132, the good layer, while the cuts made against No. 137, the poor layer, are shown on the right. The fact that the poor layer was scored highest, taken in conjunction with similar cases reported all over the country, indicates that breeders of fancy poultry are inclined to lose sight of the real purpose of breeding fowls, and to fix their attention on merely fancy points instead of on the egg-laying function. (Fig. 13.)

By their fruits are they judged; and although a misplaced feather on a hen's leg may disqualify her from the show room, it does not disqualify her from showing her ability to lay. For this purpose was she brought into the world, and for a well spent life only should she receive a crown of reward. Milk testing associations are rendering to the practical breeder a similar service to that afforded by egg-laying contests, although the length of the tests does not give the best opportunities to judge the real merits of an animal. Such contests, based on production, are obviously more difficult to conduct than those based on mere inspection but are commensurately more valuable.

From what has been said, it is not intended to imply that show room contests should be done away with. They have elements of too great value even to agriculturists for such drastic treatment. It is suggested, however, that the standards be changed and account be taken of yield wherever possible. It

FOURTH ANNUAL INTERNATIONAL EGG LAYING CONTEST
STORRS AGR. EXP. STATION---CONN. AGR. COLLEGE, STORRS, CONN.
NOVEMBER 1, 1914 – OCTOBER 31, 1915

VARIETY "White Wyandottes	RECORD 1ST YEAR	PEN NO. 14
OWNER Tom Barron,		BAND NO. 137
OWNER'S ADDRESS Catforth near Preston, England.		OWNER'S NO.

19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL MO.	TOTAL TO DATE
NOV.																																	
DEC.																																	
JAN.																												X			X	2	2
FEB.										X	X	X	X			X	X	X		X	X	X	X										

FOURTH ANNUAL INTERNATIONAL EGG LAYING CONTEST
STORRS AGR. EXP. STATION---CONN. AGR. COLLEGE, STORRS, CONN.
NOVEMBER 1, 1914 – OCTOBER 31, 1915

VARIETY White Wyandottes	RECORD 1ST YEAR	PEN NO. 14
OWNER Tom Barron,		BAND NO. 132
OWNER'S ADDRESS Catforth near Preston, Eng.		OWNER'S NO.

19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL MO.	TOTAL TO DATE
NOV.						X			X	X	X		X			X		X		X	X		X	X	X	X		X	X			15	15
DEC.	X	X	X		X	X	X		X	X	X		X	X	X	X		X	X	X	X	X	X	X		X	X		X	X		24	39
JAN.	X	X		X	X		X		X	X	X	X		X	X	X	X	X	X		X	X	X	X	X		X	X	X	X		24	63
FEB.		X	X	X	X		X	X	X	X		X	X	X		X	X	X	X	X		X	X										

SCORE CARDS THAT TELL THE REAL STORY

Incompleted egg-laying records (up to February 23) of the two White Wyandotte hens shown in Fig. 12. The one which scored higher by ordinary standards has laid very few eggs, while the one which scored lower by ordinary standards has proved to be an excellent layer. In the light of such records as these, breeders are beginning to ask themselves whether the present poultry standards encourage breeding merely for fancy points or for real usefulness. (Fig. 14.)

is for the genetist, largely by biometrical methods, to test out the utility points and for the standards to recognize these at their actual value when discovered. Efforts have already been directed to this end by investigators. If the protein content in the corn kernel is roughly proportioned to the amount of horny endosperm, as seems to be the case, this character can be added to the score card for judging high protein ears, to adduce a single example from plants.

HENS SHOULD LAY EGGS.

An example from poultry may be taken from Table II. This table shows the relative value of ear-lobes, beak and legs, and of these parts combined, in selecting Leghorns with high egg records. If these same relations are found to hold for other times of the year than October, when the color records were taken, and are found to be equally significant under other environmental conditions, it would not be difficult to assign to color in different parts of a bird in this breed the proper number of points on the score card. It does not seem unreasonable to disqualify from the show room any hen or pullet that does not show evidence of being in a laying condition, and to refuse to admit to registry in the "Standard of Perfection" any new breed that has not made a reasonable record in an egg-laying contest. Such a procedure would do much to improve the laying qualities of the different breeds.

With the pure fancier this paper has no complaint. He is to the agricultural breeder what the amateur photographer is to the professional. He has done much for genetics, but he breeds primarily as a pastime, not for profit. The sale of pets is of course a profitable

industry, and even the agriculturist must often cater to the demand for fancy points in his market. The public prefers a red-skinned apple to a yellow one. In some markets, asparagus must be bleached, in others green to obtain a ready sale. In New York City on the first of last February the market quotations listed white shelled eggs at 37 cents a dozen and brown eggs at two cents cheaper, while in Boston, brown eggs are preferred. Other instances could be given to show that the public needs educating to the real value of products as well as the showman to the real value of his producers.

An attempt has been made to show that fancy points have an undue prominence over utility points in the show room and thereby tend to pervert the aim of the breeder. An example is given from poultry of the demand for yellow beaks and legs in show birds of certain breeds, despite the fact that the presence of this yellow is indicative of poor laying ability. It is suggested that the show room standards be changed and greater account be taken of yield; that judges disqualify for characters indicating low yield; that efforts be made to discover to what extent visible characters are correlated with high production and that points be allowed commensurate with the degree of this correlation.

NEW PUBLICATIONS

PLANT BREEDING, by L. H. Bailey. New edition revised by Arthur W. Gilbert, Ph. D., professor of plant-breeding in the New York State College of Agriculture at Cornell University. Pp. xviii+474; 113 illus. The Rural Science Series (edited by L. H. Bailey); The Macmillan Company, New York, 1915. Price $2.00 net.

PROFESSOR Bailey's pioneer text book on plant breeding, issued 20 years ago, has gone through numerous editions, and has now appeared as an almost entirely new book, summing up the present state of knowledge on the subject and becoming what is probably the best and most complete practical handbook of plant breeding in the English language. Intended for college students, the book deals with the statistical side of heredity more than the average horticulturist will enjoy; but in this feature will perhaps lie its greatest value to the man or woman who intends to make plant breeding a profession. An interesting chapter is given to the origin of well-known varieties of cultivated plants, and another to a survey of organized work in plant genetics—"The Forward Movement in Plant Breeding." A compact glossary and extended bibliography are added, together with an appendix outlining laboratory exercises for students.

To Grow Pedigreed Seeds

Beliving that the present war furnishes an excellent opportunity for America to capture some of the seed-producing business hitherto held by Europe, farmers of Northern Idaho have formed the Kootenai Valley Seed Growers Association, of which C. W. H. Heideman, Bonner's Ferry, Idaho, is secretary. The organization is coöperative in nature and advertises that its seeds "were grown by scientific methods of selection and are as near pedigree seeds as it is possible for human to grow them." As a guide to scientific procedure, the secretary has been commissioned to compile a popular handbook on the application of modern plant-breeding methods to commercial seed growing.

HARDIER SPINELESS CACTUS

Present Commercial Varieties of Prickly Pear Suited to Very Limited Range—Selection of Favorable Variations in Native Species Gives Promise of Providing Forms That Will Stand Zero Temperature.

DAVID GRIFFITHS
Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C.

IN a consideration of spineless prickly pear culture on anything like a comprehensive scale, the first and most important necessity consists in making it applicable to a greater territory. At present, the crop is not to be considered in our southwest, except in California and the least frosty portions of Arizona. It is not to be thought of in New Mexico, nor Texas, except in the southernmost extremity; and the indications are that it can be only imperfectly grown on our gulf coast, and is adapted to only a portion of the coastal region of Florida. So far as the mainland of the United States is concerned, then, there is only a comparatively small territory to which the present spineless varieties are applicable.

The limiting factor is one of temperature, the plants not being able to endure temperatures any lower than the orange. Just where the danger point lies is as difficult to state as it is with any other crop; because contributing factors are numerous, poorly understood, and exceedingly influential in varying the effect of given temperatures.

During the January freeze of 1913, in California, the Department's collection was subjected to a temperature of 13° F. for at most but a few hours; only two or three spineless species escaped injury, the majority being very severely hurt and all young plants as a rule killed. In previous years, the same collection has been severely injured by temperatures of 20° of longer duration. During the freeze of 1913, on the other hand, one of the Department's coöperators at Lakeside, California, had an actual record of 8° F. in one of his cactus plantings, and the injury done was negligible. In one of the Department's plantings at San Antonio, Texas, a temperature of 20° F. with sub-freezing weather for 24 hours has always proved fatal to all of the conventional spineless species now so abundant in California, and so widely advertised in the South and Southwest generally.

From this brief survey, it will be readily seen that exact temperatures give us no more information with this crop than with any other. The data of value here as with other crops is gained from actual growing records. The region in which the plants succeed is the one to which the crop is adapted. The various varieties have now been tested over a wide enough territory so that we are able with certainty to limit the crop as at present constituted to the region suggested above.

BASIS FOR IMPROVEMENT.

At the present time, there is in this country a considerable wealth of material to work with. There are four or five good botanical species of rapid-growing spineless prickly pears. These in turn can be divided still further into what would in other groups be recognized as at least twice that number of horticultural varieties. Besides these 10 or more forms already spineless, there are not far from 100 species of all grades of spininess having qualities which place them in the economic class and make them of economic possibility. But since we have in mind mainly the production of spineless forms suitable for colder territory, species applicable to our use become very much restricted in numbers. For reasons which will become apparent later, our hopes center

in a few species outside of the known spineless forms.

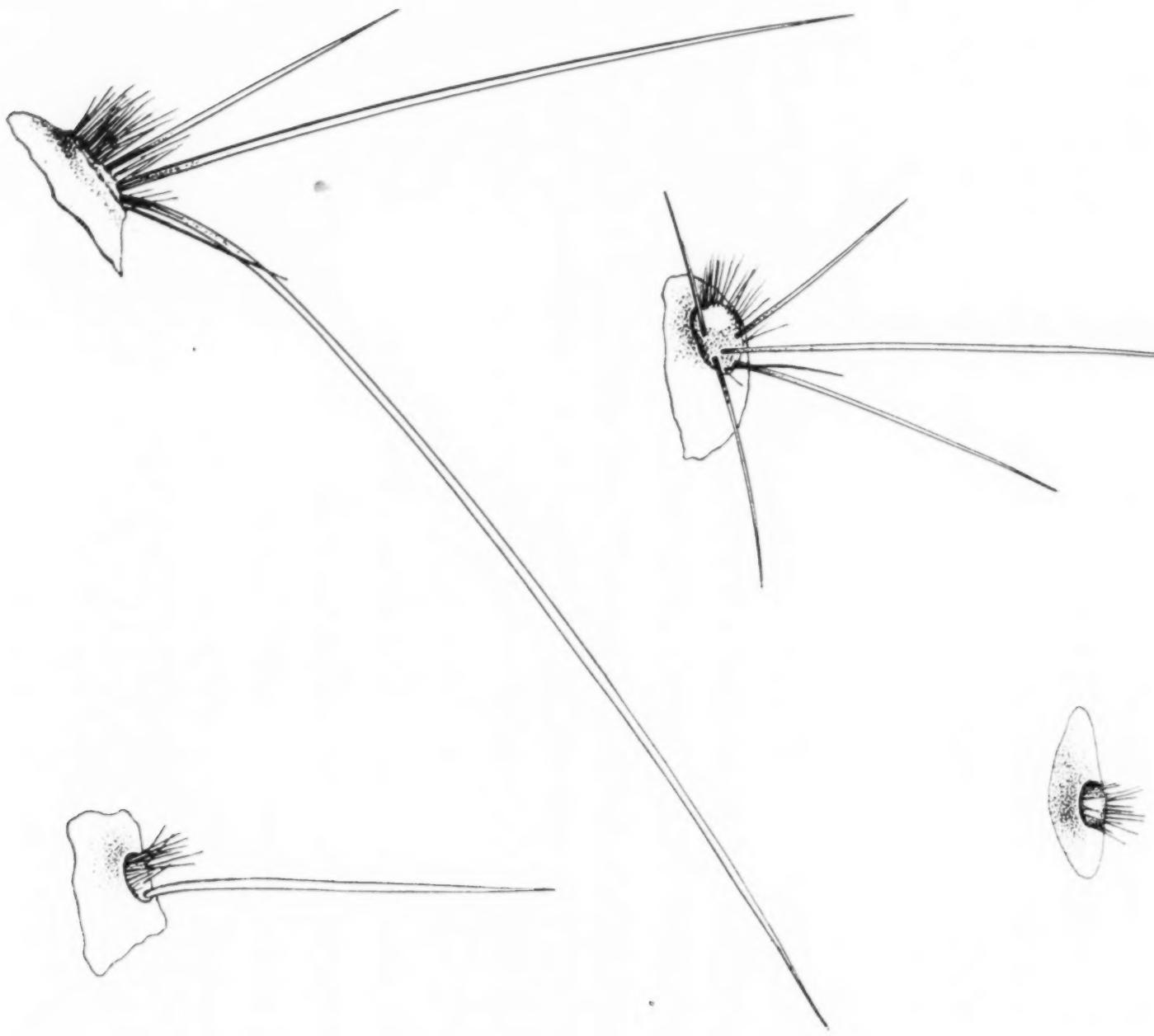
Since all of the conventional spineless prickly pears are tender to frost conditions in this country, there is no hope of making decided improvement in this group of plants within itself. Dependence must necessarily be placed in the native species of the United States, which are best adapted for this purpose. In the selection of our plants, we must keep constantly in mind three requisites; the first and foremost being tonnage of production; second, resistance to cold; and third, spinelessness. Since the crop is of low nutritive value, comparing with sorghum hay at a ratio of 10 to 1 (*i. e.*, 10 pounds of green succulent pear equal in feeding value 1 pound of good sorghum hay), it is absolutely essential that a comparatively large tonnage be secured in order to make it worth while to grow the crop. Our task is so to increase resistance to cold that the crop may become applicable to a greater territory. But while doing these two things, it is imperative that we maintain the spineless character. However, we may allow our notions of spinelessness to become rather lax, for cattle are able to thrive on quite rough feed; and absolute spinelessness has never been attained in any of the species thus far. All of the so-called spineless species bear a few of the annoying spicules; and the majority of them, some spines as well. Nevertheless, the so-called spineless species of today are sufficiently smooth for cattle to eat with impunity; and we can, therefore, adopt the average of them as our standard of spinelessness very safely.

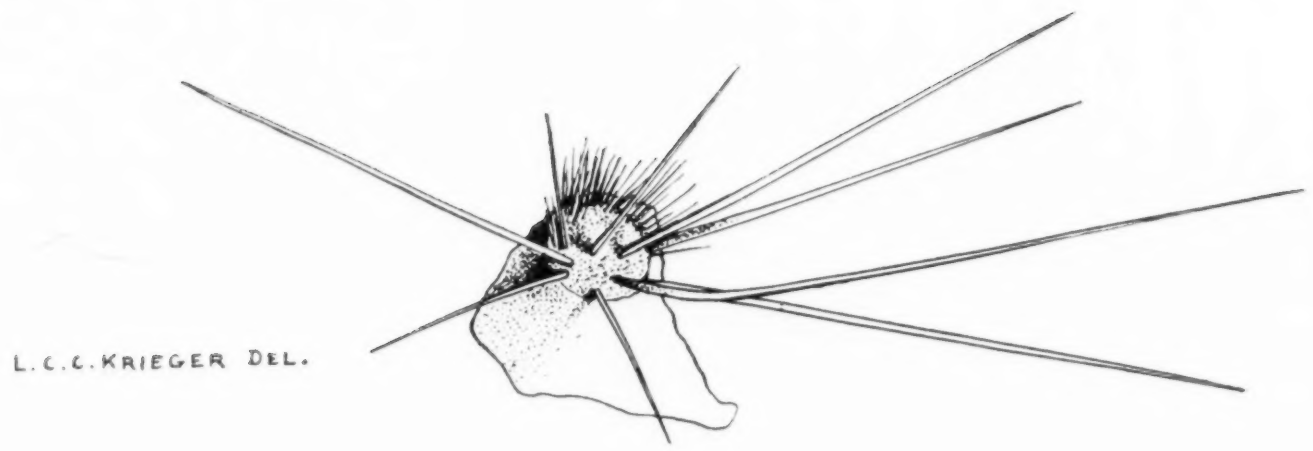
The conventional spineless forms meet the requirements not only of spinelessness, but a number of them are sufficiently productive as well. Our problem, therefore, is very much simplified in that we need to increase hardiness only, while maintaining, of course, the other two characteristics. As stated above, there is practically no hope of being able to increase the hardiness of these forms within themselves; for they are all tender. It is, therefore, necessary to look for characters outside of the present spineless species which can be bred into them. The native hardy species of this country—and for obvious reasons it is to the species of this country that we are obliged to turn for hardy characteristics—are for the most part spiny, and on the whole unpromising. They furnish stock food after being singed, but that does not concern us in this study. Many of the species, however, are very variable in spination; and some spiny hardy natives of Texas have individuals almost if not quite destitute of spines; although they all have plenty of the spicules. The latter, however, are also variable; and individual plants may be found with comparatively few of them present. These are the main characteristics which appear to bear upon our problem of increasing the hardiness of these plants; and it has been with such ideas in mind that the work along this line has been conducted.

NATIVE SPECIES EXAMINED.

For the past seven years, a constant watchfulness has been exercised to discover the least spiny of the hardy native species; and the attempt has been not to go too far north for these, but to work with the expectation of pushing the crop, say 200 miles farther north, or in other words, to increase hardiness so that the species will stand, we will say, temperatures of 0° F., or possibly a little lower. It has been considered that an attempt to make too great leaps will inevitably lead to disaster, for the species which are hardy to temperatures of 20° below zero are very unpromising both from the nature of their spines, and from their small stature and slow growth. Our ambition has been rather to produce economic spineless species which will thrive in the present pear region of Texas, say as far north as Austin.

Thus far, expectations have in a measure been fulfilled; and three, possibly four or five, species have been selected which are very promising for further breeding purposes. It is rather remarkable that in these selections, field judgment has not always proven reliable; for plants have not always





A WIDE RANGE OF VARIATION

A single pulvinus or cushion of spines from each of five varieties of the prickly pear known to botanists as *Opuntia cacanapa*. The long stiff spines vary in number from 0 to 9. It is not difficult to breed most of the spines out of a variety of prickly pear, but it is much more difficult to eliminate the short, tender spicules which cluster around the base of the spine. Most varieties of "spineless cactus" lack spines but still possess a certain number of spicules; this makes them unpleasant to handle but does not absolutely prevent their use as stock feed, since cattle can handle quite rough feed. Illustrations about one-half natural size. (Fig. 15.)

turned out as well as was expected when they were found. Forms of *Opuntia dillei* were once looked upon as promising; but these have long since been proved of no value—at least so far as three or four forms which we have carefully studied are concerned. In all of these investigations, the desire has been to secure as a starting point for hybridizations the least spiny plants possible consistent with a reasonable expectation of rapid growth. Out of 3000 forms collected only three, with a possible additional two more, are now

PROMISING MATERIAL FOR BREEDING

A practically spineless selection of *Opuntia cacanapa* under cultivation at San Antonio, Texas. The plant is four years old from cuttings, and probably not more than three or four spines will be found on the entire plant. This does not mean that spicules are absent, but their presence is not a fatal defect. The species here shown is a native of Southern Texas and a product of selections by the U. S. Department of Agriculture. Numerous varieties are recognized—in fact, the great range of variation (see Fig. 15) in this species is one of the characteristics which makes it most suitable for the attention of the genetist. (Fig. 16.)

A COMPLETELY SPINELESS CULTIVATION

Two-year-old plant of *Opuntia subarmata*, a native of Southern Texas and a result of selection in the work of the U. S. Department of Agriculture to produce hardier varieties of spineless cactus for the Southwest. This plant is perfectly spineless, and the number of spicules is not large. This species will stand from 12° to 20° more cold than the commercial varieties of spineless cactus at present known, which are too tender to be grown except under most favorable conditions. (Fig. 17.)

considered at all promising for this purpose. These, we think, belong to as many botanical species.[1]

As stated in a previous publication, some of the species which are fed very successfully in southern Texas are not adapted at all for our purpose because of being persistently spiny. However, in one general region of Texas the native species normally are very variable in spination; and occasionally plants are met with which are very nearly or even quite destitute of spines. The greatest variation the writer has ever known in a single species of prickly pear is exhibited in *Opuntia cacanapa*. This species as conceived when it was first described has one erect white or bone-like spine to each areole or cushion of spines. Further study has proven that its spines may be three or even six in number; and one plant of "cacanapa" has been found, which is nearly destitute of spines, and has even the number of spicules somewhat reduced. Vegetatively propagated selections from this are now entirely destitute of spines. The latter form is described beyond; but it will be instructive at this point to glance briefly at some of the diversities which are encountered in this species—or no doubt some one will say "group of species;" for we have here either one species, or we have more than one. The important fact, though, from our standpoint, is that one form is nearly or quite spineless, and remains so when propagated vegetatively.

MUCH VARIATION FOUND.

When this species or this group of species is studied broadly, one finds greater differences than constitute good species elsewhere in the genus. There is, however, a scarcely definable something that links the different forms together unmistakably. And this something is a quality that does not require a trained botanist to recognize. Indeed, the Mexican peon will point to all these forms with unerring certainty as "caca-

[1] A peculiar condition is found in one California species wherein the variation occurs, not between the individual plants but upon the joints of a single plant. This has not yet yielded to selective influences.

napa." It makes no difference whether it is the form with the single erect spine, the smooth, or the exceedingly spiny one that he is dealing with. Sometimes he will apply a qualifying adjective to designate the different forms. But they are all "cacanapa" to him.

The artist has brought out the difference in fig. 15, so that little further need be said. It may be added, however, that the differences in what we consider varieties in this species are greater than those used to distinguish species in other groups. The differences are not confined to spines alone; in varying degrees, they are those of the entire range of characters used for taxonomic purposes. The species is typically glaucous; but many individuals are yellowish-green, and it is in the yellowish-green varieties that the greatest spination occurs. Typically, the joints are subcircular; but there is little regularity in shape, except in so far as the individual or groups of individual plants are concerned. There is, however, a striking similarity in the fruit of the entire group of varieties, a similarity possessed by this and one or two other species.

In the illustrations are shown differences in spination mainly, that being the most striking variation. With these spiny forms is to be compared the spineless, but not spiculeless, variety shown in fig. 15. There are but few species in southern Texas more spiny than *Op. cacanapa;* and likewise, no native species with fewer spines. There are other species which from some standpoints are more promising for breeding purposes in this pear region; but their constant spininess renders them unfit. This is simply another instance of the oft-repeated principle that those plants and those only are favorable objects for selection which have great range of variation.

Our experience with these plants leads us to think that there are no species more promising for increasing the hardiness of the spineless prickly pears than *Opuntia cacanapa*, *Op. ellisiana*, and *Op. subarmata*. To these may be added *Opuntia bentonii;* two or three other varieties rather closely related to *Op. subarmata;* and one apparently entirely without spines, but having spicules in about the same proportion as typical *Op. bentonii*. At present this is thought to be a variant of *Op. bentonii*. Since breeding work with these species is already well under way, it is desirable to have the forms we are using characterized and fixed in type as accurately as may be for purposes of later comparison as well as to record the facts of the selection of such rare plants among an abundance of very spiny species on the one hand, and on the other, very spiny individuals of the same species. It is very probable that the conventional tender spineless forms owe their origin to much the same process of selection as here employed; but it has continued through many generations of time. Some of it has been conscious and some unconscious; some of it American and some European.

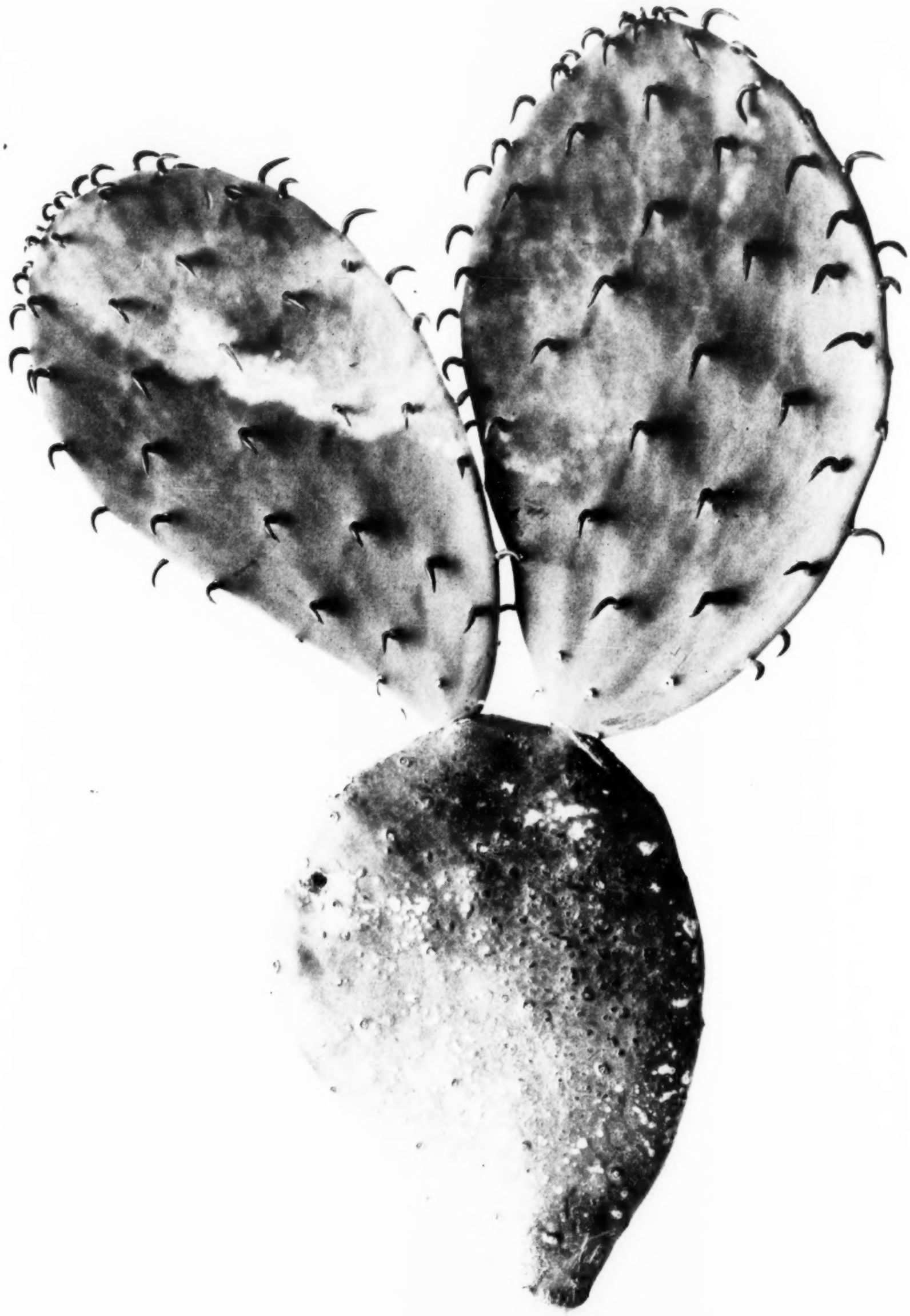
Opuntia cacanapa Griffiths.

An erect or ascending, spreading, open-branched species, reaching a height of 1½-2 m., and a spread of branch of 1½-2¼ m.; joints subcircular, about 16 x 18 cm., glaucous, gray-green, when mature, but turning more yellowish by loss of bloom in age; areoles white when young, turning tawny at maturity, and dirty gray in age, subcircular to broadly obovate, 3 mm. long on edge, smaller on sides of joints, becoming subcircular and somewhat larger when old; leaves long, prominent, oval in section, arising from an abrupt small tubercle, 1 mm. high, 16-17 mm. long, subulate, cuspidate, broadly arched backwards; spicules light yellow, unequal, scattered through entire edge of areole, but more prominent above, with the wool in the center and 1 or 2 mm. high on edges of joints, 3-5 mm. long, but much shorter on sides; spines almost absent; only an occasional one in a rare areole 1 or 2 cm. long, seldom seen; flowers deep yellow, about 7 cm. in diameter when open, and petals 5 cm. long, filaments yellow above, greenish tinged at base, style white, stigma white, 8-parted with long linear divisions; fruit red throughout, small, obovate to subglobose, 3-4½ cm. in diameter with comparatively thick rind.

This variety of *Opuntia cacanapa* is of medium rapid growth, somewhat slower than *Opuntia lindheimeri* of the San Antonio region. In structure it is somewhat more fibrous, and the joints are not so thick. This is characteristic of all of the varieties of this species.

DETAILS OF A VALUABLE PRICKLY PEAR

Old and young joints, flowers and bud of *Opuntia subarmata*, an entire plant of which was shown in Fig. 17. This plant is a perfectly spineless one, with few spicules, and was selected from a mass of spiny plants of the same kind in the Devil's River region of Texas. It is now being propagated by cuttings, so that it is not likely to revert to the ancestral, spiny condition of the species. The old joint, at the bottom, shows the spineless condition; the young joint, above, shows the rudimentary leaves, which drop off in a few weeks. It will be remembered that the prickly pear plant consists merely of stems, which are flattened out; the leaves were long ago reduced, in the process of evolution, to slight fleshy protuberances such as here shown, which are soon lost. (Fig. 18.)



A DESIRABLE FORM, READY TO HAND

The Mexican population of Southern Texas is believed to have produced this admirable spineless prickly pear, *Opuntia ellisiana*, by conscious or unconscious selection of the hardy but usually spiny native species. Here the spines have not only been abolished, but the spicules have been almost wholly eliminated, as well. In nearly all other spineless forms, the spicules are more numerous. The fleshy hooks on the young joints at the top are rudimentary leaves, which will soon drop off. Professor J. C. Ellis of the University of Texas first discovered this form among the Mexicans in the outskirts of Corpus Christi, Texas. It is hoped that the hardiness of the form here shown, which will endure a temperature of close to zero, Fahrenheit, can be combined with the valuable commercial qualities of other parents, and an ideal spineless cactus produced for the Southwestern States. (Fig. 19.)

The plants are upright in habit, and while not compact in growth, they are stout and firm and never lax, sprangly or ungainly in habit. Its slightly fibrous condition is the main disadvantage for breeding purposes. However, this may be mitigated if characters happen to be properly combined, in that it is desirable to add strength to some of our present spineless forms of the Indian fig group. Being free from spines, not especially infested with spicules, and able to withstand temperatures of the San Antonio to Austin, Texas, regions without any injury, it is one of the promising forms for increasing hardiness of the more tender spineless stocks. Figure 15 accompanying the text well illustrates the great range of variation in spination of this species.

OPUNTIA SUBARMATA Griffiths.

Plant upright to ascending, rather compactly branched, making a shrub 1¼-1½ m. high, and nearly 2 m. in diameter; joints oval, obovate to subcircular, commonly 17-25 cm. in diameter, broadly to narrowly rounded above, glaucous, bluish-green, changing through yellowish to brownish, and finally to gray, scaly; areoles elliptical to ovate or subcircular, 3-6 mm. in longest diameter, 3½-4½ cm. apart, tawny, changing to dirty gray or black, enlarging but slightly with age; spicules yellow, about 2 mm. in length, never formidable, numerous, nor increasing in length with age; spines none; flowers yellow, developing a faint tinge of red along midribs of petals as day advances, opening at 8:00 a. m., and fully open by 9:00, 7-8 cm. in diameter when fully opened, petals 4 cm. long, filaments white above, greenish below, style white below, very slightly greenish tinged above, stigma large, deep, dark green, 11-parted; fruit purple throughout, bearing light tawny subcircular areoles 1-2 mm. in diameter, having a small central tuft of yellow spicules; seeds flattened, regular, about 4 mm. in diameter, prominently notched at hilum, with marginal callus about ¾ mm. wide.

This species is based upon this spineless form, two collections of which have been made in the type locality, neither one of which has developed any spines under cultivation. Other closely related forms, considered to be of the same species, have been secured in the same locality. They have yellowish bone-like spines an inch or more long, in very varying numbers. The cold resistance of the species is probably somewhat greater than that of cacanapa; and on the whole, it is a more promising species for breeding purposes, for it more closely resembles the best native economic species of Texas in both fiber content and succulence. It was selected some years ago in the region of Devil's River, Texas, where the spiny forms are common enough; but this spineless one is rare. It is found at the base of the limestone cliffs, so abundant in this region. Although rare, I have seen three or four plants which were perfect[1]y spineless. It has been vegetatively propagated at San Antonio and Brownsville, Texas, and Chico, California. At none of these places have any species been developed.

OPUNTIA ELLISIANA Griffiths.

Plant spreading, ascending, laxly to compactly branched, 1-1½ m. high, and 1¼-2 m. in spread of branch, depending upon moisture and fertility conditions; joints light, pale, glaucous, green, when young, but yellowish shortly after maturity, broadly obovate, about 20 x 24 cm., slightly elevated at areoles when young; areoles at first almost cottony white, turning gray, and finally black, small, 2-3 mm. in diameter, after leaves have fallen and maturity has approached, made up of a central papillum in which the spicules are produced surrounded by a depressed groove separating it from the outer zone of gray or white wool; leaves long, prominent, circular in sections or slightly flattened, subulate, cuspidate, broadly arched backward, 12-15 mm. in length; spicules light yellow, never prominent, scarcely visible, few and only 1 mm. or less in length, scarcely distinguishable except by feeling from the central papillum of wool in which they are situated; spines entirely absent; flowers deep yellow, changing to orange, reddish when closed, some of the outer perianth segments dull, greenish red in bud, about 6 cm. in diameter when open, filaments and style white, stigma very light greenish yellow, 7-parted; fruit pyriform to hemispherical, deep reddish purple throughout, young ovary thickly beset above with small white subcircular areoles 3 mm. apart, and 1½ mm. in diameter, the wool being prominently raised to 1 mm. or more in a compact columnar tuft, from center of which are produced 1-2 delicate yellowish fugaceous spines, 2-3 mm. long and 1-3 or 4 minute spicules 1 mm. long or less, the lower part of ovary having only 1-3 spicules, and the areoles being much farther apart.

It is thought that all of the material of this species in cultivation today has been grown from stocks secured at Corpus Christi, Texas. The origin is not known, but it has evidently been in cultivation a long time. It is now

quite widely distributed in collections due to the efforts of the Department and Professor J. C. Ellis, who first found it cultivated by Mexicans in the outskirts of Corpus Christi. There are indications that it has been derived by selection from native forms of southern Texas; but the evidence is not conclusive. It is perfectly hardy at Austin, and doubtless is fully as hardy as *Op. cacanapa*, and possibly as hardy as *Op. subarmata*. In growth it is not as good as the other two; but it is much more smooth, approaching if not quite equaling in this respect the smoother forms of the Indian-fig group. Another feature is the few spicules on the fruits. On these accounts, the species is quite promising for breeding purposes.

While these three forms appear to be the most promising, and are the ones upon which the greatest effort is being expended at present, it is not at all impossible that other selections may be made of as great, if not even greater merit. One nearly spineless form recorded under my collection No. 9087, from Webb County, Texas, is a rapid, very succulent, wavy jointed, compact form, as good as any of the above, were it not for its few spines. It is probably very close to, if not the same as, forms of *Opuntia subarmata*, mentioned on another page. Another selection made last year is a remarkably smooth form of *Op. bentonii*. It is thus far devoid of spines, but has quite prominent spicules. This grows rapidly, but its joints are as thin as those of *Op. cacanapa*.

The difference in cold resistance of these forms is not great. They will withstand from 12 to 20° lower temperatures than the conventional spineless ones of today; and will probably all be hardy throughout the entire pear region of Texas.

SUMMARY.

The main problem associated with spineless prickly pear culture today is to increase the resistance of these plants to low temperatures.

Hardy native species of the United States, more particularly of central Texas, are thought to be the most promising source of hardiness.

Three, with a possible additional two, selections have been made from the Texas region which are considered very promising, and which have been successfully crossed with the tender spineless species.

The selections already made have resulted in the production of forms of native hardy species which are entirely devoid of spines, and which remain spineless under cultivation. These forms are also as rapid of growth as the spiny natives of the Texas region.

Bud Selection Fails

Bud selection from high producing and low producing strawberries carried on through twelve years showed absolutely no gain in productiveness by selecting runners from high producing parents, at the Missouri agricultural experiment station.

Raspberry Breeding

In the work of raspberry breeding at the New York State agricultural experiment station (Geneva), it is reported that "two series of crosses involving over 700 seedlings have proved '*Rubus neglectus*' to be a hybrid between *R. strigosus* and *R. occidentalis*. At the same time some very interesting white fruited seedlings have appeared and also a seeming mutation, a dwarf, which appears to indicate from its numbers that certain of our raspberries carry dwarfness as a recessive character. Although the crossing of the named varieties has proved unusually successful, much of the future work with both Rubus and Ribes will be in hybridizing species. Already some interesting hybrids have been secured between *Ribes nigrum* and *Ribes oxyacanthoides*. To further this hybridization work the station is making a collection of species of these two genera."

THE POMERANGE

A Natural Hybrid Between the Orange and Pomelo

THE readiness with which members of the Citrus family yield results to artificial cross-pollination, as witness the citrange and tangelo, gives rise to some wonder as to why there are so few natural hybrids in the family. The bees and other insects, whose constant visitation of the flowers must cause, in the course of time, a frequent interchange of pollen between the orange, lemon, pomelo, lime and citron, seldom make their influence felt in the production of new fruits. The most probable solution of the matter, it seems to me, is that the fruit is nearly all sent to market, and the seed that might bring forth the hybrids is thus lost to cultivation.

Two well-marked hybrids of the pomelo have appeared in the seedling orange grove of the late E. D. M. Perkins, at Winter Garden, Orange County, Florida, and both were produced without the intervention of artificial means.

Soon after the disastrous freeze of February, 1895, Mr. Perkins left his grove and removed to the National capital. For fifteen years the place was practically neglected. Groups of sprouts growing around the stumps of the frozen trunks became large bearing trees.

During a sojourn on his place in the winter of 1910, Mr. Perkins noticed a tall tree having the general appearance of the pomelo, but which bore fruits of a deep golden color, egg-shaped and of large size, some of them weighing as much as two pounds each. They were found to be quite tart, with a thick, white inner rind having the characteristic bitterness of the pomelo, and with abundant seeds. The flavor was quite like that of the pomelo, but with more acid than the better sorts, although the fruit was found to improve in sweetness as it hung longer on the tree. The fruits were found growing in large clusters like the pomelo, but the color was like that of a superior orange. There was no russeting of the coat, and the surface was smooth and glossy.

One peculiarity of the Kegler orange, with which Mr. Perkins stocked his grove, was a plainly marked ring or nimbus, from one to one and one-half inches in diameter, at the blossom end of the fruit, indicating some admixture of navel strains, and this sort of a circle was found on the same place on the new fruit.

Specimens of the new hybrid were sent to the writer by his father, on whose place it was found, with the statement that it was undoubtedly a natural cross between the pomelo and orange. The name of "pomerange" was suggested for the fruit by the writer when he forwarded the specimens to the pomologist of the Bureau of Plant Industry in January, 1911, and it was described and entered under that name at the time, in the Bureau. So far as known, the tree has borne regular crops since, maintaining in every particular the size, color and quality of the fruits first noticed.

The flavor of the pomerange is rather too tart, when it first ripens, but later a more distinct orange taste develops. The fruit is a real pachyderm, as the skin is in some places, notably at the stem end, nearly an inch thick, but this feature adds much to its good shipping qualities. The tree is now owned by Adam C. Perkins, of the Post-Office Department in Washington, a son of the original owner and discoverer of the fruit.

The other hybrid, probably a cross between the pomelo and the lemon, is of a very tart and somewhat bitter taste, and perhaps worthy of only a passing notice. In shape it is like the ordinary pomelo, but of a deeper color, and the oil cells are very large and abundant.

LINDSAY S. PERKINS.
Washington, D. C.